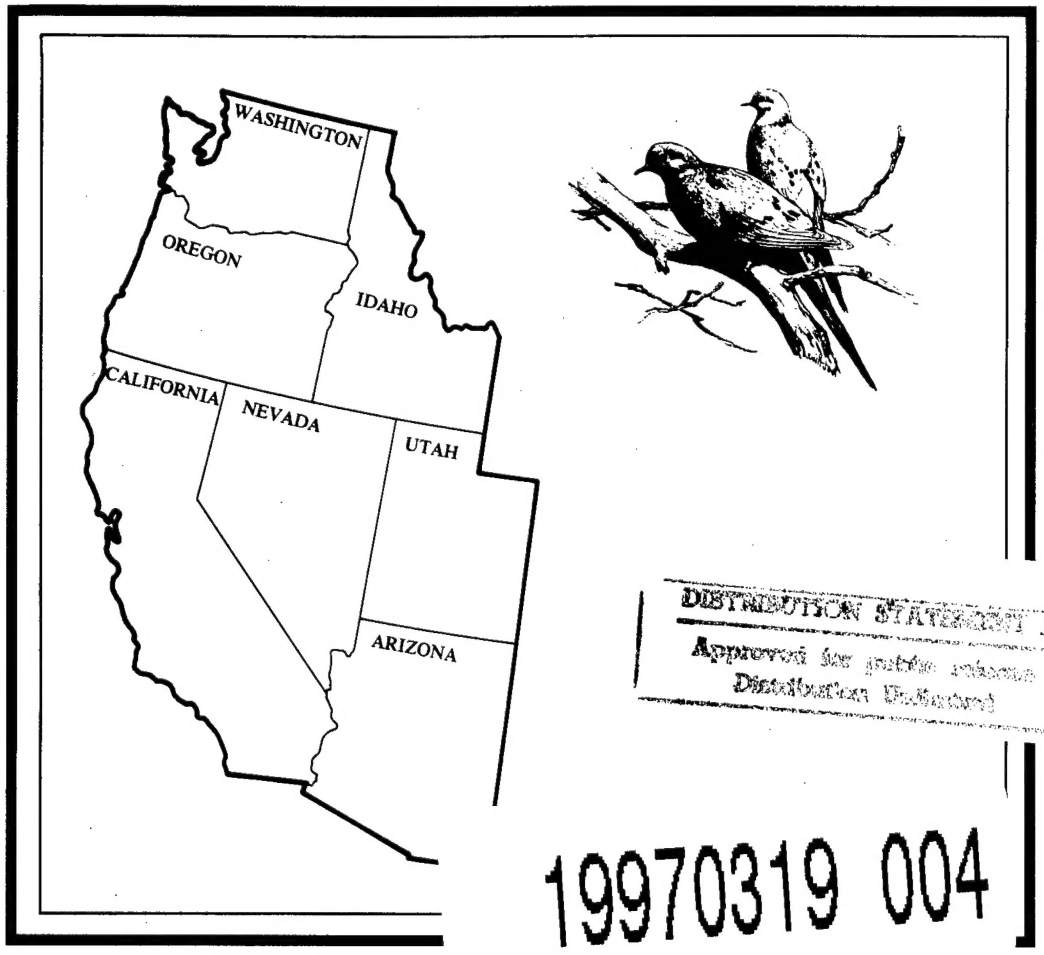
Migration, Harvest, and Population Characteristics of Mourning Doves Banded in the Western Management Unit, 1964–1977



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Abstract

A nationwide banding program for mourning doves (*Zenaida macroura*) was conducted cooperatively by State wildlife agencies and the U.S. Fish and Wildlife Service during 1967–1975. Banding and recovery records, as well as data from annual call-count and harvest surveys for the seven States that compose the Western Management Unit (WMU), were analyzed by a subcommittee of the Western Migratory Upland Game Bird Technical Committee.

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This report presents information about mourning dove habitats, hunting regulations, and harvest in the WMU; distribution and derivation of band recoveries in and from the WMU; distribution of mourning dove harvest in Latin America from the WMU; chronology of migration; survival and recovery rates; effects of hunting on WMU mourning dove populations; and an indirect estimate of the nationwide mourning dove population. Comparisons of these WMU data are made with similar data from a companion study in the Central Management Unit (CMU; Dunks et al. 1982).

Of 88,540 doves banded preseason in the WMU, 4,165 (5%) were subsequently recovered and reported. Of the 2,859 direct recoveries, most were obtained within the WMU (93%) and in Latin America (>6%); less than 1% was reported from the CMU and none from the Eastern Management Unit (EMU). Three-fourths of the WMU harvest was taken in Arizona (41%) and California (32%). Of doves originating in the WMU and recovered in Latin America, 98% occurred in Mexico and 2% in Central America. The southern terminus for doves migrating from the WMU is substantially farther north in Mexico than for doves from the CMU, and centered in the Western Highlands (chiefly Jalisco and Michoacan).

Migrating doves from northern WMU States first reached Arizona and California by early September, but the majority arrived in mid- to late September. Most doves had passed through those States by November. The peak arrival period in Mexico was mid-October.

Average annual survival rates of adult and immature mourning doves banded in the WMU were 52 and 35%, respectively; average annual recovery rates were 2.2 and 3.2%. Mourning dove survival was significantly lower in northern and coastal areas than in southern and interior areas of the WMU, although the differences may have been due to coincidental factors unrelated to geographic conditions.

The proportion of total annual mortality (calculated as 48% for adults and 65% for immatures) due to hunting was estimated at 21 and 22%, respectively.

The average fall flight population of mourning doves in the 48 conterminous States was estimated at 470 million birds, 76 million from the WMU.

Introduction

Management Unit Concept

On the basis of an early analysis of banding data, Kiel (1959) concluded that the United States contained three largely independent mourning dove (*Zenaida macroura*) populations. As a result, the Western Management Unit (WMU), Central Management Unit (CMU), and Eastern Management Unit (EMU) were established in 1960 (Fig. 1). These units encompass the principal breeding, migration, and U.S. wintering areas for each population; most doves produced in a unit are harvested there. Management decisions have been made within these units since their establishment.

History—Banding Program

In the mid-1960's, a cooperative mourning dove preseason banding program between the U.S. Fish and Wildlife Service (FWS) and the States was conducted nationally. This project was coordinated through the Southeastern Dove Technical Committee and the Central and Western Migratory Shore and Upland Game Bird Technical Committees. Resultant banding data for the Eastern Management Unit were analyzed and published by Hayne and Geissler (1977), followed by an analysis for the Central Management Unit by Dunks et al. (1982). The present analysis for the Western Management Unit is an extension of the Dunks et al. report and uses many of the same analytical techniques. Because of the similar techniques and data presentation of the CMU and WMU analyses, much of the usual introductory material has been omitted. To fully understand the material presented herein, the reader may refer to the Dunks et al. (1982) report.

Federal–State Management Responsibility

Mourning dove management is primarily a Federal responsibility delegated by the Migratory Bird Treaty Act of 1918. This Act, as amended, implements the migratory bird treaties between the United States and other countries. The treaties with Great Britain (for Canada) and Mexico include mourning doves and recognize sport hunting as a legitimate use of the migratory bird resource. The Federal Government follows the provisions of the Act to determine to what extent (if any) the hunting of

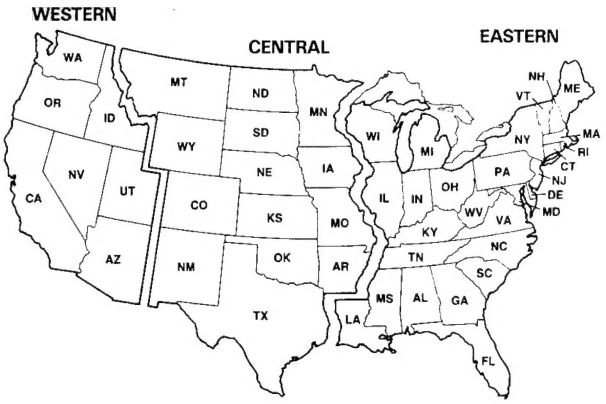

Fig. 1. Western, Central, and Eastern mourning dove management units.

migratory game birds is to be permitted. State wildlife agencies have played an important role in supporting and supplementing Federal migratory game bird management programs. Activities have included habitat acquisition, conduct of research and management activities, establishment of hunting regulations within the Federal frameworks, support of law enforcement, and development of information and education programs (U.S. Fish and Wildlife Service 1975).

Overview of the Mourning Dove

Data on life history and biology of mourning doves are detailed in a number of publications (e.g., Hanson and Kossack 1962; Keeler 1977; U.S. Fish and Wildlife Service 1977; Dunks et al. 1982; and Geissler et al. 1987). Several key aspects of dove biology are summarized below.

Distribution and Abundance

The mourning dove is one of the most abundant and widely distributed birds in the United States (Robbins and Van Velzen 1969). Dunks et al. (1982) and others have estimated the fall population at between 350 and 600 million birds. The species has a wide nesting distribution in North America (Aldrich and Duvall 1958; Dunks et al. 1982) and ranges from the southern Provinces of Canada (Godfrey 1966; Salt and Salt 1976; Armstrong 1977), south into Mexico (Leopold 1972) and the Greater Antilles (Lack 1976). It is a highly adaptable species and occurs in most ecological types except marshes and heavily forested areas. Doves use habitats for nesting that vary from open grasslands in the Great Plains to trees and shrubs in residential areas.

Two subspecies of mourning doves are recognized in the United States (Aldrich and Duvall 1958): *Z. m. marginella* occupies the western two-thirds of the country and *Z. m. carolinensis* occurs east of the Mississippi River. A zone of overlap from Michigan through eastern Texas contains an intermediate form of the two races. Doves from the WMU are of the *Z. m. marginella* subspecies.

A southward migration of mourning doves occurs annually beginning in late August. In general, most doves in the northern half of the breeding range, and many in the southern part, winter in the southern United States, Mexico, Central America, or the West Indies (Keeler 1977). In the western United States, Arizona and California winter large numbers of doves (Miles 1976). Some populations of doves that breed in the wintering range appear to be nonmigratory (Leopold and Dedon 1983).

Population Monitoring

A nationwide call-count survey is conducted annually during a 15-day period in May and June to monitor breeding mourning dove populations. The survey encompasses more than 1,000 routes randomly located throughout the 48 conterminous States. On each route, the numbers of doves heard calling are recorded during a 3-min period at each of 20 listening stops spaced at 1.6-km intervals. The average number of birds calling per route provides a basis for determining indices to breeding population size. The indices are believed to be valid for detecting major annual changes in breeding population size at the management unit level and for determining long-term population trends for States and management units. This information is used by wildlife administrators to set annual hunting season regulations.

Importance of Breeding Areas

The breeding density of mourning doves varies throughout the United States depending on habitat and food availability. Each different habitat type or physiographic region contains randomly distributed call-count survey routes (Dolton 1977). To illustrate the relative density of doves among management units, Dunks et al. (1982) averaged the number of doves heard calling on the routes between 1967 and 1975 for each physiographic region. However, since then it was determined that average counts for the WMU had become inflated due to the base-year method of analyzing call-count data (Dolton 1982). Averages for the CMU and EMU were relatively unaffected. Therefore, for the present report, the raw or unadjusted data were averaged for density comparison.

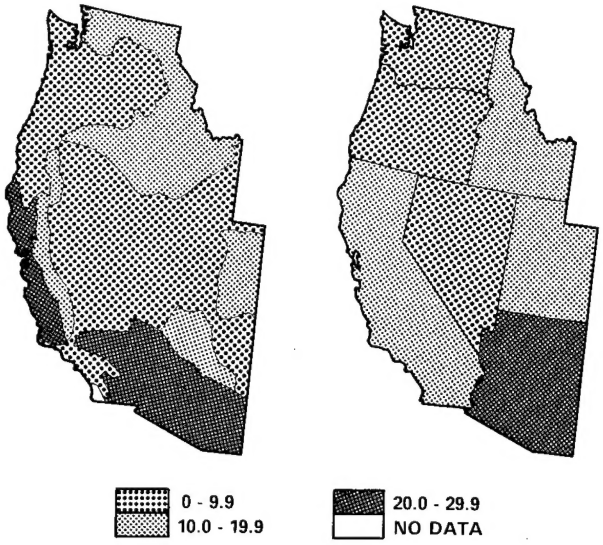

Fig. 2. Average number of mourning doves heard per route by physiographic region and State (after Dolton 1977).

Generally, average dove densities in the WMU were lower than in the CMU or EMU as illustrated in Dunks et al. (1982).

Highest dove densities in the WMU were found in the southern quarter of the unit and in intermountain valleys of California's coastal ranges (Fig. 2). Low dove densities, however, prevailed throughout most of the unit, primarily in the Great Basin and the forested areas of the North, Northwest, and Rocky Mountains. State averages were determined by weighting averages within each region by the proportional land area that the regions represented within a State. Arizona had the highest breeding dove density; Idaho, California, and Utah had midlevel breeding densities; and Nevada, Oregon, and Washington contained the lowest densities.

The relative size and importance of dove breeding populations for each State and management unit can also be illustrated by Breeding Population Indices (Table A-1). These indices were obtained by weighting the average number of calling birds per route by the size of the land area in which they were located. The WMU constitutes about 24% of the land area of the United States and contained about 16% of the breeding dove population during 1967–75. The western tier of WMU States (Washington, Oregon, Nevada, and California) makes up 15% of the U.S. land area and contains 7% of the Nation's doves. The eastern tier of WMU States (Idaho, Utah, and Arizona) makes up 9% of the land area and contains 9% of the breeding population.

Western Management Unit Mourning Dove Habitat

The WMU is characterized by a variety of vegetational types because of its expanse and heterogeneity in elevation, topography, and climate. The WMU in general—and California in particular—has the most diverse vegetation zones in the United States. As a result, mourning dove habitats in the West follow a more checkered pattern than regions of the country where vegetation is more homogeneous.

Elevations range from the lowest to the highest points in the conterminous United States. Maximum and minimum temperatures vary from highs of >45°C in desert areas of southern Arizona, Nevada, and California, to lows of <−18°C in mountainous areas (U.S. Geological Survey 1970). Coastal temperatures are moderated by westerly winds from the Pacific Ocean. More variable temperatures occur inland beyond the oceanic influence, according to elevation and latitude. Winter precipitation and summer drought characterize coastal areas, whereas inland areas receive most of their precipitation during summer. Annual precipitation in some southern desert areas averages <5 cm, but exceeds 325 cm along the coast of the Olympic Peninsula in Washington.

Vegetation reflects the different altitudinal, climatic, and edaphic conditions in the WMU. Natural climax vegetation is limited in portions of the unit because many areas have been significantly modified in some respect by man's activities, particularly by grazing, logging, farming (including irrigation), fire suppression, water reclamation, industrialization, and urbanization.

Habitat may be described by various standards, including its natural vegetation and its present use and composition. As in Dunks et al. (1982), we chose to describe the vegetation by the system devised by Kuchler (1964) and later modified by the U.S. Geological Survey (1970). The modified Kuchler system includes 106 vegetation types, 47 of which are present in the WMU. In addition, local areas of extremely arid desert, alpine areas, lava flows, and surface water are essentially without vegetation. For the present paper, the Kuchler vegetation types were consolidated into six major groups, plus an unvegetated group (Fig. 3).

The **needleleaf forests** occupy the upper elevations of the Rocky Mountains, the Mogollon Plateau of Arizona, the Sierra Nevadas, and the Cascade and Coast ranges, as well as the intervening lowlands of western Washington, Oregon, and northwestern California. The last area supports some of the most luxuriant needleleaf forests in the world, and consists of dense stands of tall Douglas-

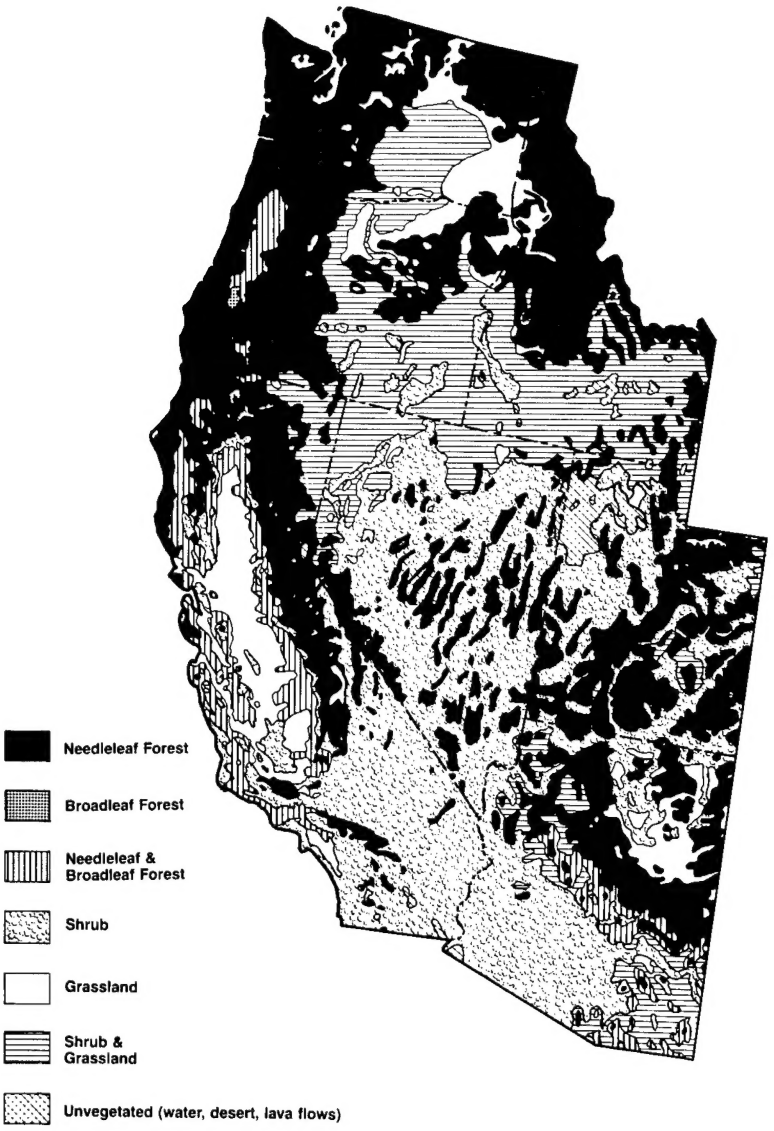

Fig. 3. Vegetation types in the Western Management Unit.

fir (*Pseudotsuga menziesii*), true fir (*Abies* spp.), spruce (*Picea* spp.), hemlock (*Tsuga* spp.), western redcedar (*Thuja plicata*), pine (*Pinus* spp.), and, locally, redwood (*Sequoia sempervirens*). Despite their prominence, particularly as old-age stands, the needleleaf forests represent poor mourning dove habitat. Dove call-count surveys generally indicate fewer than 10 doves heard per route in the modified needleleaf forest regions. Representative averages include eight doves heard per route in the Coast Range, four per route in the Cascade Range of Washington and Oregon, nine in the Sierra Nevadas, six in northern Idaho, and none in the relatively primeval forests of the Olympic Peninsula, Washington. Dove densities as high as 17 per route are found in the southern needleleaf forests of central Arizona.

Broadleaf forests in the WMU are essentially limited to the Oregon oakwoods (*Quercus* spp.) of the Willamette Valley, and mesquite (*Prosopis* spp.) bosques in the extreme south of the unit. Initially, both forest types were somewhat limited in size. Much of the Oregon oakwoods have been cleared for agriculture and only scattered tracts remain. The distribution of mesquite in grasslands has been increased by livestock feeding, whereas many of the dense thickets along watercourses have been cleared by phreatophyte control programs. Call-count data do not reflect the value of the broadleaf forests because of limited

survey coverage, but mesquite thickets are known to provide good dove nesting habitat (Cottam and Trefethen 1968).

The **mixed needleleaf and broadleaf forests** of the WMU are likewise restricted in area, and exist chiefly in the foothills of the Central Valley and Coast Range of California, and central and southeastern Arizona. In the first locale, needleleaf forest species are intermixed with oaks. In California, the major types include oaks, Pacific madrone (*Arbutus menziesii*), firs, and pines. In southern Arizona, the type is characterized by oaks and junipers (*Juniperus* spp.). The mixed forest in Oregon has been much reduced by clearing for agriculture, and elsewhere by a combination of lumbering and grazing. Although definitive call-count data are lacking for this restricted habitat type, it supports moderate dove densities.

Shrub vegetation dominates vast expanses of the central and southern Great Basin, the Colorado River drainage, and the deserts of southern California and southwestern Arizona. Sagebrush (*Artemisia* spp.) is the major shrub in the northern Great Basin but in more southerly, arid, steeper, or more alkaline areas it is replaced by a variety of shrubs including creosote bush (*Larrea tridentata*), chaparral (*Arctostaphylos* spp. and *Ceanothus* spp.), mountain-mahogany (*Cercocarpus* spp.), saltbush (*Atriplex* spp.), greasewood (*Sarcobatus vermiculatus*), paloverde (*Cercidium* spp.), and cactus (*Opuntia* spp.). The shrub habitat has been extensively modified by livestock grazing and clearing, and locally by conversion to dryland and irrigated farming. The northern shrub zone occupies most of Nevada, adjoining California, and western Utah. Call-count survey data indicate dove densities of 11 birds per route. Higher densities—as many as 26 doves per route—occur in deserts of southwestern Arizona and adjacent California, making the region the highest breeding dove density area in the WMU. We speculate that these high densities result from the mourning dove's adaptation to hot, dry climates; its ability to fly long distances to water; abundant food supplies afforded by desert vegetation; and water, food, and shrub and tree plantings associated with irrigation.

Mixed shrub and grasslands characterize the northern Great Basin, Snake River drainage, and lower elevations of the Columbia River watershed of Washington and Oregon east of the Cascade Range. Sagebrush is the dominant vegetation, augmented by many grasses. On steeper terrain, scrub juniper, mountain-mahogany, and other woody shrubs replace sagebrush. Because of intensive grazing during the past century, a proportion of vegetative cover has shifted from grasses to shrubs, particularly with the increase of sagebrush. Fire suppression has also allowed shrubs to dominate. In general, the mixed shrub and grassland type of southern and northern Oregon and southern Idaho supports higher dove densities (21 to 23 doves per route) than the adjoining shrub type to the south. Although no certain explanation is available, the former has more fertile, well-drained soils; more extensive irrigated farming; expansive dryland farming areas devoted to cereal grain production; and more shrubs and trees associated with farms and urbanized locales. All of these factors are conducive to larger dove populations.

Grasslands originally were scattered throughout the WMU. These areas included the Palouse Prairie of southwestern Washington and nearby Idaho, the foothills and steppes of northeastern Oregon, and east-central Arizona. The type also includes the alpine meadows of the higher mountain ranges. Major grasses include fescues (*Festuca* spp.), wheatgrasses (*Agropyron* spp.), needlegrasses (*Stipa* spp.), bluegrasses (*Poa* spp.), and gramas (*Bouteloua* spp.). Vast tule marshes (*Scirpus* spp. and *Typha* spp.) dominated the watercourses and seasonally flooded bottomlands of the Central Valley of California. The grasslands have been modified greatly by agricultural development and presently provide habitat for moderate densities of breeding mourning doves (e.g., 10 doves per route in the Palouse Prairie and adjoining grasslands and 13 in the Central Valley).

Basically **unvegetated areas** of the WMU include the extensive salt flats west of Great Salt Lake in Utah, lava flows in southeastern Idaho, alkaline sumps in Nevada and Utah, and extremely arid deserts in southwestern Arizona and southern California.

The mourning dove has adapted as a breeding, migrating, or wintering species to nearly all WMU habitats except possibly the high alpine meadows and extensive tracts of climax needleleaf forests. It is basically a tree- or shrub-nesting species, although it frequently nests on the ground when trees are unavailable. The dove generally shuns deep forests but readily uses open woodlands and the "edge" between habitat types. It is a seedeater that has readily adapted to cultivated small grains such as wheat.

Man's activities have greatly affected the original habitats of the WMU. An important change began with the breaking of grasslands and shrublands for grain production in Utah during the 1860's (Smith 1979). The practice of "sodbusting" initially commenced with settlement, but most of this activity occurred during and after World War II. Mechanized harvesting leaves large quantities of waste grain in fields for doves and other wildlife. The planting of trees and shrubs for field and farmstead shelterbelts created preferred nesting sites and roosting

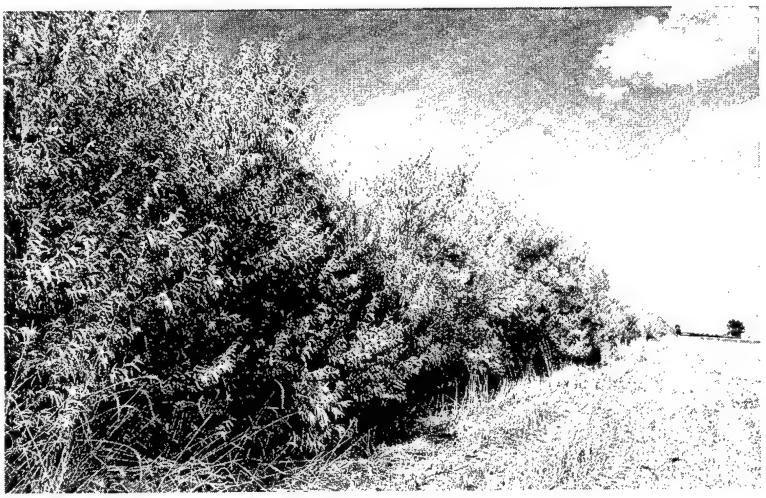

Fig. 4. Mourning doves nest in high densities in planted shelterbelts of the Western Management Unit. This one in Idaho is composed mainly of Russian olive (*Eleagnus angustifolio*). (*Photo by R. B. Branstead, USDA-SCS.*)

habitat (Fig. 4). Farm impoundments, stockponds, and irrigation ditches were readily used by doves for daily water intake (Fig. 5). Mature fruit orchards were also used for nesting (Fig. 6).

The introduction of gravity flow irrigation into the Great Salt Lake Basin of Utah in 1847 by the Latter-Day Saints (Smith 1979) ensured agricultural productivity necessary for settlement. Irrigation farming spread with the Mormons through Utah, southern Idaho, and northern Arizona wherever adequate water supplies and arable soils existed. Irrigation districts, formed after passage of the Reclamation Act of 1902, were organized to convey water from Bureau of Reclamation structures to individual farms. Because of acreage limitations of the Homestead and Desert Lands Acts, individual farms initially remained small. This small and diversified farming produced a habitat complex that was favorable to mourning dove use and increase (Fig. 7). Some of the highest dove breeding opulations in the WMU occur where this type of farming still persists.

After World War II, improved drilling and pumping equipment combined with cheap electricity enabled farmers to convert more and more land to irrigated cropland. Unfortunately, the expanded pump irrigation lowered water tables over broad areas and caused water sources to become less dependable and more costly. Because gravity irrigation is frequently inefficient and wasteful of the limited water supplies, self-propelled,

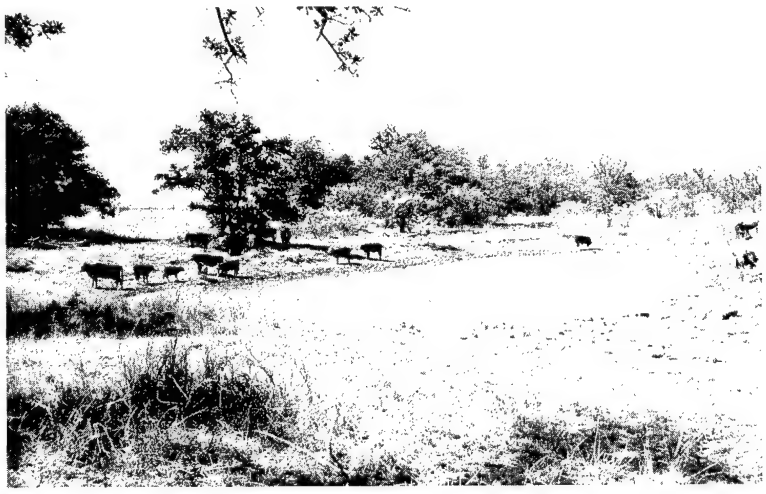

Fig. 5. Shallow stockponds provide drinking water for mourning doves and help disperse their populations. (*Photo by S. H. Coleman, USDA-SCS.*)

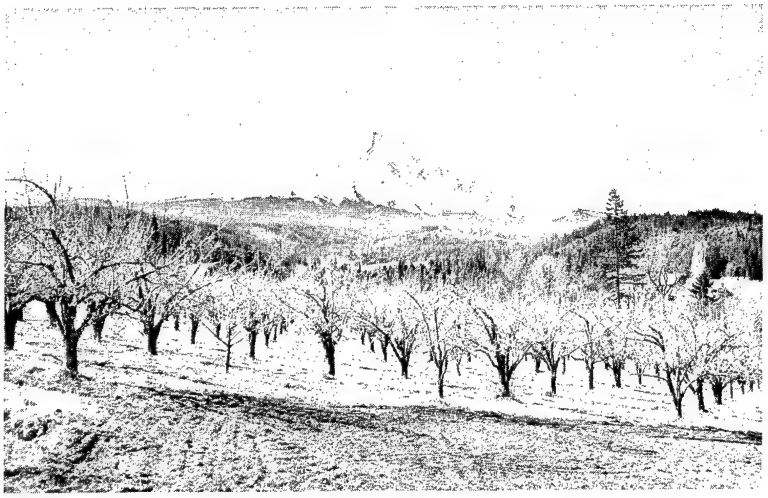

Fig. 6. Mature fruit orchards provide excellent nesting habitat in the Western Management Unit, particularly in Oregon and Washington. (*Photo by W. Sauerwein, USDA-SCS.*)

center-pivot sprinkling systems were developed to ensure more uniform watering patterns (Fig. 8). For these advanced systems to function, obstacles such as individual trees and shelterbelts had to be removed. Excellent dove nesting habitat created earlier thus was reduced in some areas.

The Central Valley of California is renowned for its production of vegetables, fruits, cereals, and nuts for human consumption, and for forage and grain used by livestock and poultry. Mourning doves have readily adapted to this regime. In recent years, however, high land values and operating costs have forced farmers to make their operations as productive and efficient as possible. Many individually owned farms have given way to highly mechanized corporate farming in which monocultural crops are grown on huge tracts. In certain areas, cereal grains have been replaced with cotton. Channing (1979) cites intensive farming, reduction of stubble fields or feeding sites, and sprinkler irrigation in orchards as causes of reduced dove numbers and production in the Central Valley near Turlock. Conversely, he concluded that urban and suburban dove habitat within the city of Turlock has improved.

Mature forests of the northwest generally support few doves. As the logging industry advanced into climax forests, clearings provided an edge habitat favored by doves. Although forest regeneration frequently filled the clearings, others were maintained for farms, pastures, and

Fig. 7. Small, diversified farmlands along rivers provide food, water, and nesting habitat favorable to mourning doves. (*Photo by H. Bryan, USDA-SCS.*)

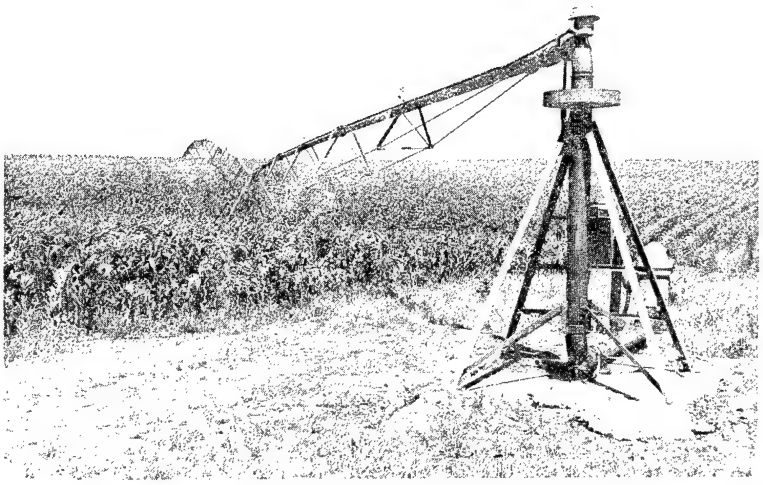

Fig. 8. Conversion to center-pivot sprinklers may have reduced dove populations in some areas because tree obstacles and free-flowing irrigation ditches have been removed. (*Photo by E. O. Peterson, USDA-SCS.*)

towns. Forest fires (Fig. 9) also created openings that take years to revegetate. The resultant habitat diversity has led to a modest expansion of range and an increase of dove populations in the forested areas that were formerly devoid of the species.

Phreatophytes, such as willows (*Salix* spp.), cottonwoods (*Populus* spp.), mesquite, and saltcedar (*Tamarix* spp.), provide valuable nesting habitat for mourning doves in the arid Southwest (Fig. 10). Stands of these trees depend on groundwater obtained from extensive taproot systems and compete with cultivated crops for this commodity. For example, an acre of saltcedar may consume 5 or more acre-feet of water annually (U.S. Senate 1960). Consequently, large-scale reclamation projects have been undertaken to eradicate phreatophytes. These clearings have been especially detrimental to mourning and white-winged (*Zenaida asiatica*) doves in Arizona (Wigal 1973). California recently enacted legislation to protect this important wildlife habitat.

Fruit and nut orchards in many areas of the WMU also provide excellent nesting habitat for mourning doves. In the important fruit-producing areas of Yakima, Washington, and elsewhere, doves formerly nested in moderate numbers. However, the practices of replacing standard-sized apple trees with semidwarf varieties and the use of elevated sprinkler irrigation has seriously deterred dove nesting and production there (D. L. Zeigler, unpublished Federal Aid report; Fig. 11). Citrus orchards in Arizona,

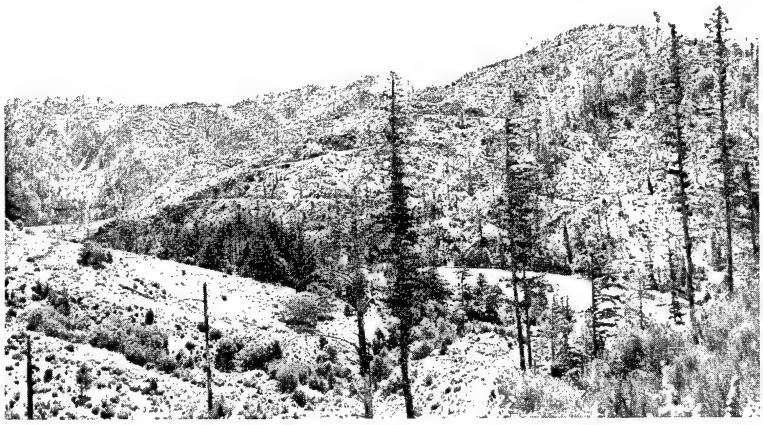

Fig. 9. Fires and logging in forested areas of the Western Management Unit have created habitat diversity favored for nesting by mourning doves. (*Photo by W. M. Payne, USDA-SCS.*)

Fig. 10. Thick stands of the exotic saltcedar (*Tamarix* spp.) are valuable as nesting habitat in the arid Southwest of the Western and Central Management Units. (*Photo by C. N. Gilbert, USDA-SCS.*)

formerly important dove production areas, are rapidly being cleared and replaced with more cost-effective crops (Wigal 1973).

Livestock grazing can be beneficial to doves by opening understory in brush or timbered areas and encouraging weed seed production (Fig. 12). However, overgrazing, which has been common throughout the West, causes long-term soil deterioration and loss of grass and forb seeds. This practice has undoubtedly had an adverse effect on dove populations.

Thus, man's activities have been both beneficial and harmful to mourning dove populations in the WMU. When viewed in relation to presettlement conditions, we subjectively conclude that the overall effects of man's activities up to 1977 had favored the maintenance—if not the increase and expansion—of mourning doves in the WMU. However, recent evidence (Dolton 1985) suggests that dove populations are now declining in the West. Habitat losses may be responsible. Continuing changes in land use and agriculture must be closely monitored to ensure the future well-being of this important wildlife resource.

Mourning Dove Hunting Regulations and Harvest

Hunting Regulations

The number of mourning doves harvested, including

Fig. 11. Conversion to overhead sprinkling systems in fruit orchards has discouraged nesting and reduced mourning dove production in Oregon and Washington. (*Photo by G. F. Stubbe, USDA-SCS.*)

Fig. 12. Grazing by livestock can create weed seed production for mourning dove food, but long-term soil deterioration may ultimately be detrimental to Western Management Unit habitats. (*Photo courtesy of USDA-SCS.*)

temporal and geographical distribution of recoveries, is directly affected by hunting regulations. Therefore, the length and timing of hunting regulations in effect during the study period are important for interpreting data collected during that time.

Annual migratory bird hunting regulations are set within frameworks established by the FWS in cooperation with the States. State regulations may be more restrictive but not more liberal than the Federal frameworks.

During the entire study period, annual mourning dove season lengths for each unit, as established in the frameworks, were: WMU, 50 full days; CMU, 60 full days; and EMU, 70 half days. Seasons could be split into no more than 3 segments and had to occur between 1 September and 15 January. Historically, all States in the WMU customarily opened their mourning dove season on either 1 or 2 September, and they continued to do so during the present study (Table A-2). Except in 1967 (12-bird bag), a daily bag of 10 doves was allowed for the WMU and 12 for the other units. In the EMU, an 18-bird limit was allowed for a special study in 1969 and 1970. Possession limits after the first day were twice the daily bag limit.

Mourning dove hunting seasons are also promulgated annually in Mexico. During the study period, they varied widely by year and geographic region. Generally, hunting seasons began in the northern part of the Republic in August and ended 31 October. The rest of the country initiated dove seasons in October or November with closing dates as late as 28 February. This considerable inconsistency among years and regions hindered our interpretation of migrational chronology in the present analysis. In Central America, formal hunting seasons were generally nonexistent, although dove hunting occurred there. A more thorough discussion of hunting in Latin America is found in Dunks et al. (1982).

Hunting

More mourning doves are harvested each year by hunters in the United States than all other game birds combined. Mourning dove hunting provides an estimated 11.4 million recreational trips (Keeler 1977) by 2–3 million people annually (U.S. Fish and Wildlife Service 1975).

Dove hunting is most popular in the Southern States due, in part, to the relatively long time birds are available. Local doves are taken early in the season, but migrants constitute much of the bag in late season hunting. Because of the southward migration of doves from Northern States in September, the time available to hunt doves in these States may last only 1–2 weeks.

Mourning doves are also hunted in Mexico and Central America on their winter range (Blankenship and Reeves 1970). Resident hunting is usually through the auspices of hunting clubs. Hunting by nonresidents is a valued type of tourism and, during the years of study, Mexico and several Central American countries promoted hunting by tourists.

Harvest

Since there is no uniform nationwide harvest survey, estimates of the total harvest of doves in the United States are unreliable. Past estimates were based on guesswork, compilations of incomplete State statistics, or indirect

computations from several data sources such as banding and recovery data. Even though error may be involved in these estimates, they can be used as gross approximations of the harvest for chronological comparison.

The mourning dove harvest has undoubtedly increased during the past four decades. The estimated harvest was 11 million birds in 1942 (McClure 1944). By 1949 it had increased to about 15 million (Dalrymple 1949) and by 1955 to 19 million (Peters 1956). The U.S. dove harvest had increased to about 41 million by 1965 (Ruos and Tomlinson 1968), and the most recent estimate is 49 million (Keeler 1977).

The dove harvest in the WMU was compiled from individual State estimates. All States in the unit conduct a random card survey of small game license holders; however, these surveys are not standardized. Results indicate that, on the average, 430,000 hunters bag about 7.3 million mourning doves in the WMU annually (Table A-3). It is also possible to estimate harvest by multiplying the U.S. harvest figure of 49 million by 0.29, the WMU proportion of the total harvest as estimated by Ruos and Tomlinson (1968). This method gives a WMU harvest figure of 14 million. We believe this figure is inflated, but the large difference between the two methods of estimating harvest illustrates the need for a uniform harvest survey throughout the United States. In the CMU, the annual dove harvest was believed to be between 12 and 14.7 million birds, with dove hunters probably exceeding 600,000 (Keeler 1977; Dunks et al. 1982). An estimated 1.3 million hunters bag about 29.5 million doves annually in the EMU (Keeler 1977).

In Mexico and Central America, the magnitude of the harvest is unknown. As tourism increases, the harvest will most likely increase.

Western Management Unit Preseason Banding Program

During the early 1960's, analysis of existing mourning dove banding data revealed a need for larger and more representative banding samples from throughout the United States. The FWS, working with the respective Management Unit Dove Technical Committees, planned a comprehensive nationwide mourning dove banding program. The program was designed to improve quality and distribution of dove banding throughout the country. In the WMU, banding of mourning doves began in 1964 and continued through 1975. However, the nationwide program was delayed because several States could not participate initially or fully. The nationwide banding effort eventually spanned 9 years, from 1967 through 1975. Except for estimation of survival and recovery rates, data for the WMU were restricted to those years for the analysis to be comparable to information from the other two units.

Annual banding quotas were established as guidelines for all participating States (Martinson 1969, 1971). The annual U.S. quota was set at about 175,000, and each State was to contribute about 3,000–5,000 bandings each year (smaller eastern States had quotas of only 250 bandings, and California and Texas had quotas of 8,000). Instructions to State agencies emphasized the need for wide distribution of banding effort according to physiographic stratification throughout each State. No more than 500 birds were to be banded in any one area.

The WMU banding effort was coordinated through the Western Dove Technical Committee (now called the Western Migratory Upland Game Bird Technical Committee), an auxiliary of the Pacific Flyway Council. The banding effort was cooperatively undertaken chiefly by State and Federal banders; some private banders also participated. Much of the banding effort by State fish and wildlife agencies was supported by contracts issued under the Accelerated Research Program (Sandfort 1977) and by Federal Aid to Wildlife Restoration projects.

Objectives of Banding and Underlying Assumptions

Dunks et al. (1982) listed and defined some population parameters that can be estimated from banding data. These include rates of recovery, harvest, kill, and annual survival, and indirect estimates of population size. In addition, banding and recovery data can be used to draw inferences about dove migration: distribution, derivation, and geographical and temporal migratory patterns.

Inasmuch as banding is a sampling technique, it is important that the marked or banded sample be representative of the overall population being studied. For the WMU mourning dove banding program, planners sought to distribute the banded sample uniformly throughout the dove's range, to capture birds during the breeding season so as to establish their points of origin, and to obtain adequate samples of each age and sex class. These objectives were basically met in some WMU States but not in others because of monetary and time constraints. Geographic distribution of bandings was spotty, particularly in Washington, Oregon, Idaho, Nevada, and Arizona (Fig. 13). Therefore, some of the conclusions presented herein for those States reflect certain areas of origin more than others. In addition, chronological and age-sex data reflect some areas disproportionately in some instances. The

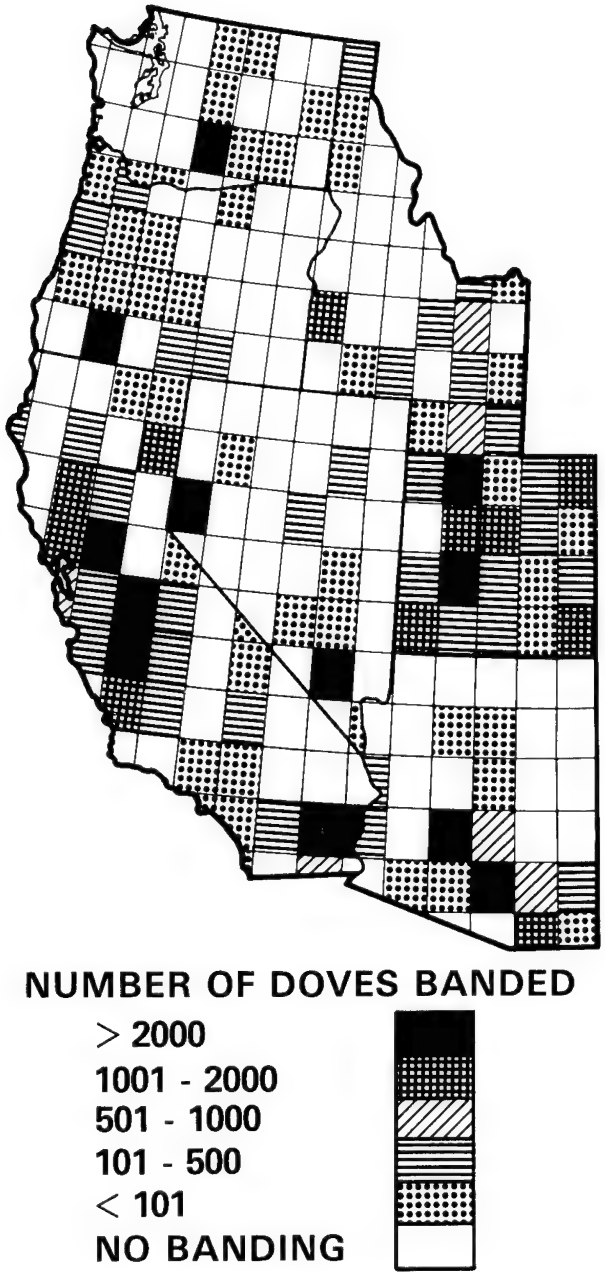

Fig. 13. Distribution of Western Management Unit mourning dove bandings by 1° blocks of latitude and longitude, 1967–75.

reader is cautioned to examine sample sizes when evaluating the strength of data being presented.

The recovery data were weighted by population and banding statistics when calculating derivation of the harvest. This practice was intended to correct not only for disproportionate sampling of population components but also for differences in the sizes of the sampled populations, and allowed comparison of the relative contributions of originating populations to specific harvest areas.

The reader should refer to Dunks et al. (1982) for assumptions used in the CMU analysis that apply to the present study.

Objectives of the Western Management Unit Banding Analysis

The objective of this report is to characterize the harvest distribution, harvest derivation, chronological pattern of migration, harvest rates, survival rates, and other population variables of mourning doves in the WMU. The analysis was confined to geographical units no smaller than States. This treatment allows the reader to view mourning dove population dynamics on a State-by-State or regional basis and should enable wildlife agencies to make sound decisions for management of mourning doves in the WMU.

As in the CMU analysis by Dunks et al. (1982), the primary and secondary data treatments, which could not be formally presented, are contained in our files. This information is available in tabular form for further analysis by interested researchers upon request. For more detailed data from specific areas, researchers are encouraged to request information in the form needed from the Bird Banding Laboratory (BBL; U.S. Fish and Wildlife Service, Laurel, Maryland 20708).

Conclusions based on this analysis have been made about specific and general aspects of dove population dynamics to help the reader interpret the presented data. However, management implications and recommendations have been omitted to allow readers to make their own decisions in this regard.

Methods

Reference Areas

Banding and subsequent recovery locations originally were identified by coordinates of latitude and longitude. However, except for a summary of banding distribution (Fig. 13), data for all coordinates have been grouped by State or other larger entity. Several geographical reference areas of the United States and Latin America adopted by Dunks et al. (1982) were also used in this study to describe patterns of recovery and migration for mourning doves. The major regions in the United States were the three management units, further divided into north-south

Fig. 14. Geographic reference areas.

oriented tiers that contained similar dove migratory patterns (Fig. 14). States were retained as the smallest geographical entities.

Mexico and Central American countries are collectively referred to as the Southern Zone. This zone was arbitrarily divided into eight geographical regions (Table A-4; Fig. 14). These divisions allowed grouping of Mexican States into areas with similar physiographic features and band recovery patterns. Except for Belize (which was included in Region 7), Central America is considered a separate region. These regions are referred to throughout the text.

Trapping and Banding

Banders were encouraged to distribute their trapping activities throughout the 3-month period of June–August and over a wide geographical area. Trapping was generally terminated at least 10 days before the hunting season began on 1 September; some trapping continued throughout August if quotas had not been met earlier. Other aspects of trapping and banding and the criteria used in sex and age identification of mourning doves are described by Dunks et al. (1982).

Data Extraction Criteria

Banding and recovery data used in this analysis were extracted from the BBL according to specified criteria (Table A-5). We selected (1) bandings and resultant recoveries of mourning doves marked in the WMU during preseason banding periods of 1967–75 and (2) all recoveries in the WMU of doves banded in the CMU and EMU during 1967–75. Recovery records, regardless of banding location, spanned 1967–77. Only records of "normal wild" banded and recovered doves were used.

In the extractions from the retrieval files, all "How Obtained" code records (U.S. Fish and Wildlife Service and Canadian Wildlife Service 1984) were initially examined to determine the proportion of recoveries that resulted from hunting-related activities. Recoveries that had been assigned to four "How Obtained" codes (00,

01, 56, and 98, and presumably related to hunting activities) constituted about 99% of all recovery records (Table A-6). For doves recovered in the United States, only hunting-related records were retained for the period 1 September through 31 January. However, for recoveries in the Southern Zone, all "How Obtained" codes were retained for 1 August through 31 May. The extended recovery period in the Southern Zone was selected because of the long and varied hunting seasons in Latin America.

The "Who Reported" code categorizes the identification or affiliation of the individual who reported the band to the BBL (Table A-7). Of the total recoveries from WMU bandings, 61% were reported by the person (or close associate) who actually shot or found the banded dove and 36% were reported by conservation agency personnel. These figures compare with 69 and 27%, respectively, for recoveries from CMU bandings (Dunks et al. 1982). All "Who Reported" codes were used in the analysis.

The "Why Reported" code identifies the impetus or cause that led to the reporting of the band (Table A-7). For WMU bandings, 81% of all recoveries were reported voluntarily and 17% were solicited. For the CMU, these figures were 93 and 4%, respectively. The difference between the two units was largely the result of band solicitation by conservation personnel at check-stations in Arizona (41% of all reported bands were solicited). Excluding data from Arizona, 91% of WMU bands were voluntarily reported by hunters and 7% were solicited. Thus, the cause for reporting bands in the rest of the WMU was similar to that in the CMU. Recoveries representing all "Why Reported" codes were retained for the analysis.

Records of birds banded in the WMU and recovered anywhere were retained if the State or foreign country was known. Locations of banded birds recovered in Mexico were further identified by Mexican State. In addition, all recoveries of birds banded outside of the WMU during the specified years but recovered in the WMU were included in the analysis.

Data used in this and the CMU analyses were extracted in fall 1977 from the banding and recovery retrieval files maintained by BBL. Banding records were extracted for all three units for 1967–75, as were recovery data from all mourning doves banded in the WMU, regardless of where recovered, and those recovered in the WMU and Latin America, regardless of where banded. The BBL's retrieval files are updated annually in early fall and include nearly all band recovery data through the previous hunting season. Thus, recoveries of doves banded in all management units were available through the 1976–77 hunting season, the second hunting season following the last year of the cooperative preseason banding in the WMU. All retrieved records were entered on magnetic tapes for further editing.

Extracted banding and recovery data were reformatted from the normal flyway boundary coding to follow the management unit configuration. These procedures are explained in Dunks et al. (1982).

Tabulations containing WMU data in the corrected format were produced simultaneously with those from the CMU. These tabulations are filed in the Office of Migratory Bird Management (MBMO), Laurel, Maryland, for future reference.

Data Limitations

Four weaknesses in deriving information from mourning dove banding data were delineated in the CMU analysis by Dunks et al. (1982). These were (1) lack of banding data from Canada and Mexico, (2) necessity of large sample sizes to counter the relatively low recovery rates for mourning doves, (3) essentially unknown reporting rates that probably vary considerably throughout areas where dove bands are recovered, and (4) the absence of a standardized nationwide dove hunter and harvest survey. These factors also apply to the WMU analysis.

The breeding dove populations of Canada and Mexico were not sampled and thus characteristics of birds in these important segments were not considered. Banded samples of doves from some States in the WMU were insufficient for estimating certain parameters with reliable precision. Recognition of this problem led to extraction of additional data from 1964 through 1966 for use in estimating survival and recovery rates. Estimates from the expanded data were improved substantially, although confidence intervals were wide in several instances. A band-reporting estimate of 32% was used for various calculations (Tomlinson 1968; Reeves 1979). Harvest statistics in the WMU were available from all seven States, but they were not necessarily derived in the same way nor from the same types of sampling sources. Their availability, however, allowed a more straightforward calculation of an indirect preseason population estimate than was possible for the CMU, in which harvest data were unavailable for several hunting States.

Representativeness of Doves Banded

Dunks et al. (1982) presented evidence that immature doves banded in the CMU during the earlier part of the banding period (June) had a greater tendency to disperse

from their banding locations before the hunting season than those banded later (July and August). Furthermore, more doves were banded later in the period, thus causing speculation that some early hatched immatures could have moved from their natal areas before being banded. This situation would violate the assumption that all birds banded during June–August were produced in the banding areas.

We examined this factor for the WMU banding data (Tables A-8 and A-9). Too few birds were banded earlier in the banding period to compare with those banded later, except for Arizona. The proportion of direct recoveries occurring outside Arizona differed among the 3 banding months (June, July, August) for immature mourning doves ($\chi^2 = 8.60$, 2 df, $P = 0.01$) but not for adults ($\chi^2 = 1.70$, 2 df, $P = 0.43$). Immature doves banded earlier in the summer exhibited a greater tendency to be recovered outside of Arizona. About 70% of the recoveries from WMU bandings were from birds banded in August and 24% in July (Table A-10). However, if early hatched immatures wandered in the WMU, as in Arizona and some areas of the CMU, some of the birds banded during July and August may not have been banded in the area in which they were produced.

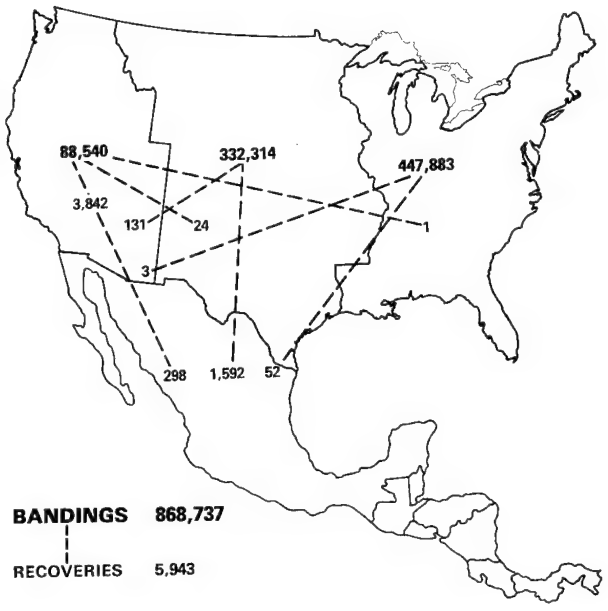

Fig. 15. Number of mourning dove bandings (1967–75) and recoveries (1967–77) used in the Western Management Unit banding analysis.

Results

Banding Accomplishments

More than 868,000 mourning doves were banded throughout the United States during preseason banding periods between 1967 and 1975 (Table A-11). Recoveries used in this analysis were from doves banded in the WMU and recovered anywhere and doves banded in the EMU and CMU and recovered in the WMU and the Southern Zone. There were 5,943 recoveries in the selected areas of reference (Fig. 15). Of the 447,883 bandings in the EMU, 52 were recovered in the Southern Zone but only 3 (all indirect) in the WMU. For the CMU, 332,314 bandings produced 131 recoveries in the WMU and 1,592 in the Southern Zone. In the WMU, 88,540 doves were banded; of these, 3,842 were recovered in the WMU, 24 in the CMU, 298 in the Southern Zone, and 1 in the EMU. Although this analysis does not directly address the integrity of the management unit boundaries, it is obvious that doves banded in the WMU tend to remain in the unit and seldom stray into other units.

Bandings in the WMU were distributed fairly evenly among years but not among States (Table A-12). Generally, the States with greater dove hunting opportunity banded more doves than those with less. Yearly bandings ranged from a low of about 7,000 in 1973 to 14,000 in 1972. Total bandings by State ranged from a low of about 3,000 in Idaho to a high of 30,000 in California. No doves were banded in Nevada during 1973–75. Good geographic distribution of bandings was attained only in California and Utah (Fig. 13). Large sections of Oregon, Idaho, Nevada, and Arizona were not sampled. The lack of uniform geographic distribution and the small banded sample of doves in some States limited the WMU banding analysis in several aspects.

Of the nearly 89,000 WMU bandings, almost 56,000 were of immature doves and about 33,000 of adults (Table A-12). Slightly more than 700 adults (2%) were recorded as unknown sex because of indistinct plumage characters. Of the 31,900 adults of known sex, the unit-wide sex ratio of males to females was 145:100 (Table A-13). For comparison, the CMU sex ratio was 187:100. The State sex ratios varied from 118:100 in Washington to 220:100 in Nevada. As discussed by Dunks et al. (1982), these ratios are weighted toward males, probably because of trapping biases.

The average WMU age ratio of immatures to adults was 171:100; State ratios ranged from 70:100 in Utah to 436:100 in Washington (Table A-13). For the CMU, the average age ratio was 121:100. Overall age ratios in both units are low and probably not representative of the true preseason population as explained by Dunks et al. (1982).

Distribution of Band Recoveries

Band recoveries from migratory game birds reflect harvest patterns during hunting seasons which, in turn, reflect migration patterns. Distribution of band recoveries from mourning doves banded in the WMU were tabulated by five age and sex categories (immatures, adult males, adult females, all adults, and total doves) and two recovery categories (direct and indirect). The resulting 10 tables illustrate the harvest locations by numbers and percentages of doves recovered (Tables A-14 through A-23). Distribution patterns also are expressed by relative recovery rate indices (RRI; Tables A-24 through A-26). These indices reflect the approximate probability of an individual bird being recovered in specific areas and allow fast comparisons among States.

The distributional analysis was restricted to direct recoveries because these records best reflect migratory pathways from specific breeding areas (Dunks et al. 1982).

Distribution from Western Management Unit States (All Ages and Sexes Combined)

The combined direct recovery data for doves of all ages and sexes are discussed here to illustrate general distribution from each WMU State. The information in this section is summarized in Table A-18.

Western Management Unit—General

Of the 88,540 bands placed on doves in the WMU during the study period, 2,859 direct recoveries were obtained. Of these, 2,668 (93%) were taken in the WMU, 13 (<1%) in the CMU, and none in the EMU. The Southern Zone yielded 178 recoveries (>6%), most of which were from Mexico (176). Birds banded in Idaho had the lowest proportion of recoveries in the WMU (78%) and those from Arizona had the highest (96%).

Washington. Of the 430 direct recoveries from nearly 9,000 mourning doves banded in Washington, 350 (81%) came from Washington and 51 (12%) from other WMU States; 26 (6%) were from Mexico (23 from the Western Highlands), and 3 (1%) from the CMU. No recoveries were reported from Central America.

Oregon. The slightly more than 4,000 doves banded in Oregon yielded 210 direct recoveries, of which 158 (75%) were taken in Oregon and 38 (18%) in other parts of the WMU; 14 (7%) came from Mexico (10 from the Western Highlands). None were reported from the CMU or Central America.

Idaho. The nearly 3,000 doves banded in Idaho produced 27 direct recoveries, of which 10 (37%) came from Idaho and 11 (41%) from other WMU States; 6 (22%) came from the Southern Zone—5 from Mexico (3 from the Western Highlands) and 1 from Central America (Guatemala).

Utah. The more than 15,000 mourning doves banded provided 151 direct recoveries, of which 80 (53%) were in Utah and 43 (29%) in other WMU States (California 10, Arizona 33). The Southern Zone yielded 24 bands (16%)—23 in Mexico and 1 in Honduras—and the CMU 4 (3%; 2 each in Texas and New Mexico).

Nevada. The roughly 6,000 doves banded in Nevada yielded 113 direct recoveries: 62 (55%) from Nevada, 40 (35%) from other WMU States, and 1 (1%) from the CMU (Texas); the remaining 10 (9%) came from Mexico (8 from the Western Highlands).

California. More doves (30,000) were banded in California than in any other WMU State. Of 1,094 direct recoveries, 1,022 (93%) were from the WMU—990 in California and 32 in Arizona; 70 (6%) came from Mexico—20 from the Northwest Coast and 49 from the Western Highlands; and 2 (<1%) were from the CMU.

Arizona. The more than 21,000 mourning doves banded provided 834 direct recoveries, of which 790 (95%) came from Arizona and 13 (<2%) from other WMU States (California and Nevada); 3 (<1%) were from the CMU, and 28 (3%) were from Mexico (18 from the Western Highlands).

Geographical Differences

Recovery rate index. The recovery rate index is the direct recovery rate multiplied by 10,000. Because RRI's from all banding locations represent recoveries per 10,000 birds banded, comparisons may be made among different banding areas, recovery areas, and age or sex cohorts of the population sampled (Dunks et al. 1982). This treatment of the data projects the approximate probability of an individual bird being recovered in specific areas and allows for fast comparisons among States. For example, the RRI's for immature doves banded in Oregon and Arizona and subsequently recovered in Mexico are 39 and 19, respectively (Table A-24). Therefore, an individual immature dove banded in Oregon is twice as likely to be recovered in Mexico as an immature dove banded in Arizona.

Migratory patterns. Mourning doves banded in the WMU remain in or migrate through the unit into Mexico and seldom deviate into other U.S. management units (Table A-18). Of the 88,540 banded birds from the WMU, only 13 direct recoveries were in the CMU; none were in the EMU. Thus, statistical comparisons of migratory patterns of doves into other units could not be

made among banding States as was done by Dunks et al. (1982).

Doves banded in Washington and Oregon were several times more likely to be recovered in California than those banded in Idaho, Utah, and Nevada (Table A-26). Similarly, doves from Utah and Nevada were more likely to be recovered in Arizona than doves from any other WMU State. This suggests that mourning doves from the WMU migrate straight south or slightly southeast.

General recovery patterns of doves banded in the WMU and CMU were compared (Table A-27). It is apparent that a bird from the WMU is more than twice as likely to be recovered in the unit of banding (RRI = 301) than a dove banded in the CMU (RRI = 124). This does not necessarily imply that doves from the WMU are less migratory. WMU States all permit mourning dove hunting whereas several CMU States do not. In addition, doves from the WMU are subjected to a higher hunting mortality in the unit, particularly in the State of banding. On the contrary, individual birds banded in the WMU (RRI = 1.47) and CMU (RRI = 1.44) have equal chances of being recovered in the adjacent unit. Similarly, an individual dove banded in the WMU has about the same chance of being recovered in Mexico as one banded in the CMU (RRI's = 19.88 and 20.91, respectively). However, a dove banded in the CMU is 13 times more likely to be recovered in Central America than one banded in the WMU (RRI's = 2.92 and 0.23, respectively).

These data indicate that the present boundary between the WMU and the CMU is an effective designation and that management decisions should be made separately within each unit (see also Braun 1979). Although doves from both units migrate into the Southern Zone, and some often share common wintering locations, the migration routes differ as does the southern terminus for each segment. Doves from the WMU apparently winter farther north in Mexico than doves from the CMU, which have a higher tendency to travel to southern Mexico and Central America. This phenomenon is discussed in later sections.

Tendency for doves to migrate to the Southern Zone. Although recovery rates for immature and adult doves differ (relative recovery rate = 1.32; Table A-64), geographic recovery patterns were similar for both age classes. Adult sample sizes were low, so data for both age cohorts were pooled. Recovery rate indices for States in both the WMU and CMU were considered to allow comparison among States throughout the entire area that contributed recoveries to the Southern Zone.

We used a chi-square test with banding and Southern Zone recovery data to test the null hypothesis that doves from all the States had similar probabilities of being recovered in the Southern Zone. As expected, this hypothesis was rejected for the 22 States tested (χ^2 = 105.99, 21 df, $P < 0.01$). Data from the States were then partitioned by inspection (*a posteriori*) into groups with similar Southern Zone recovery rate indices. Three separate groups were identified and recovery rates were subjected to chi-square testing within and among groups. The hypothesis of similar recovery probabilities was accepted within groups ($P > 0.05$) and rejected among groups ($P < 0.01$). Group I was composed mainly of northern latitudinal States (Washington and Oregon in the WMU; Montana, North Dakota, South Dakota, Minnesota, Nebraska, Wyoming, Colorado, and Oklahoma in the CMU). Recovery Rate Indices in the Southern Zone varied among Group I States from 26 to 35 and averaged 30 (Table A-28). States in Group II were basically midlatitudinal (Idaho, California, Nevada, and Utah in the WMU; Kansas, Iowa, New Mexico, and North Texas in the CMU). The average RRI in the Southern Zone for Group II was 21 and varied between 16 and 24. Group III consisted of southern States or those at the eastern edge of the CMU. These States had an average RRI in the Southern Zone of 10 and varied between 5 and 13. An individual dove from Group III States was 3 times less likely to be recovered in the Southern Zone than a dove from Group I States and half as likely to be recovered there than a dove from Group II States (Fig. 16). The same general pattern of recovery in Mexico was determined for States of the CMU by Dunks et al. (1982).

Leopold and Dedon (1983), reporting on a nonmigratory population of mourning doves near Berkeley, California, suggested that certain segments of the dove breeding population in middle to southern latitudes of the United States may have a reduced migratory urge and that some populations may be nonmigratory. The data presented herein seem to support Leopold and Dedon's conclusion. Doves from northern States in the WMU and CMU show a greater tendency to migrate to Mexico and Central America than doves from lower latitudes (Fig. 16; Table A-28). In contrast, doves banded in Arizona and South Texas exhibit practically no tendency to migrate south. Exceptions to these tendencies are doves banded in Idaho, Iowa, Missouri, and Arkansas, which would be expected to have a higher probability of being recovered in the Southern Zone. In the eastern CMU States mentioned, doves had a higher probability of being recovered in the EMU (Dunks et al. 1982), which explains the lack of Southern Zone recoveries from those States. Idaho had a small sample of banded doves but a high proportion of its recoveries (22%) came from the Southern Zone

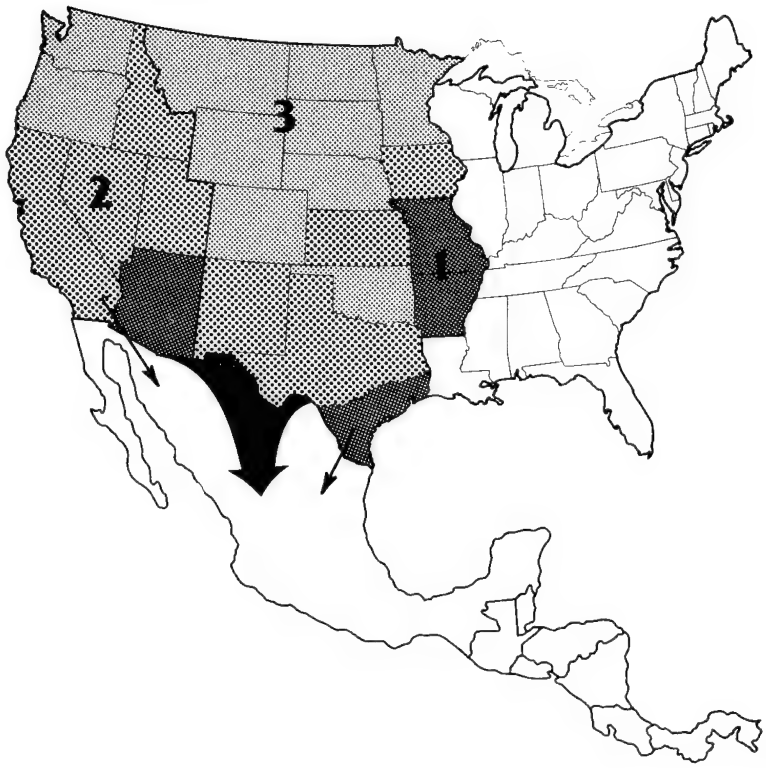

Fig. 16. Relative frequencies of recovery in the Southern Zone for mourning doves banded in designated areas of the Western and Central Management Units. Example: an individual dove banded in Arizona, Missouri, Arkansas, or South Texas is 3 times less likely to be recovered in the Southern Zone than a dove banded in northern States.

(Table A-18). Perhaps a larger sample would have yielded a higher RRI in the Southern Zone. Although our data do not offer incontrovertible proof that doves from the north are more migratory than birds from the south, our evidence certainly supports that conclusion. Furthermore, doves in mid-latitudinal areas seem to be intermediate in their migrational tendencies.

Age and Sex Differences

Dunks et al. (1982) examined in-State versus out-of-State recoveries for selected age and sex cohorts and concluded that immatures in the CMU either migrated earlier than adults or were more prone to migrate from State of banding. Similarly, adult females tended to leave the State earlier or at a greater rate than adult males. In this analysis, we made the same comparisons, although the sample sizes for adult females were small in some instances. We also compared RRI's for adults and immatures in Mexico and in the unit of banding.

Adults versus immatures. The percentage of direct recoveries occurring in State of banding was higher for adults than immatures in all WMU States except Oregon (Table A-29). However, only in Utah ($\chi^2 = 9.79$, 1 df, $P < 0.01$) and Nevada ($\chi^2 = 4.20$, 1 df, $P < 0.05$) were the differences statistically significant; in Oregon, immatures were recovered in State at a greater rate than adults ($\chi^2 = 3.18$, 1 df, $0.05 < P < 0.10$). Although not as conclusive as the findings in the CMU (Dunks et al. 1982), these data suggest that immatures in the WMU either begin their migration before adults or are more likely to migrate than adults.

To further explore this question, average RRI's for adult and immature doves banded in the WMU and CMU were computed for selected areas of recovery (Table A-30). Relative recovery rates (immature RRI's ÷ adult RRI's) for recoveries in the unit of banding were then compared with those for recoveries in Mexico and in adjacent units. For doves banded in the WMU, the relative recovery rates were 1.4 in the WMU, 7.0 in the CMU, 3.2 in Mexico, and 0.7 in Central America. For doves originating in the CMU, the relative recovery rates were 1.1 in the CMU, 2.5 in the WMU, 3.9 in the EMU, 2.3 in Mexico, and 1.0 in Central America. The uniformly higher rates in Mexico and adjacent units relative to the unit of banding suggest that immatures have a greater probability of being recovered outside the unit of banding than adults. We

conclude from this and the results presented in Table A-29 that immatures are more likely to migrate and travel farther than adults during migration.

Adult males versus adult females. The percentage of direct recoveries occurring in State of banding was higher for males than females in five of the seven WMU States (Table A-31). However, none of the differences was statistically significant (χ^2 test, $P > 0.05$). Although Dunks et al. (1982) concluded that adult females from the CMU either migrated earlier than adult males or were more apt to migrate, we cannot draw the same conclusion for WMU doves on the basis of this analysis.

Distribution of the Harvest

The distribution of harvest within a specific harvest area or areas can be illustrated using band recoveries. However, the recovery data must be weighted to adjust the raw data for differences in banding efforts among the origination areas, as well as for varying sizes of the areas and density of breeding doves within them. Each recovery thus reflects a specific number of harvested doves, and that number depends on area of origin.

Weighting factors (Table A-32) were calculated as described by Dunks et al. (1982) with one exception: The mourning dove breeding density figures were obtained by averaging the raw comparable call-count data for 1967–75, rather than the adjusted base-year data, as was done for the CMU analysis. This procedure was used because of recently identified problems associated with the base-year method of analyzing call-count data (Dolton 1985).

Possible biases in using weighted band recovery data were discussed by Dunks et al. (1982). The reader should be aware that varying reporting rates or lack of uniform hunting regulations could cause biased harvest proportion estimates.

Distribution and Density of Harvest in the Western Management Unit (All Ages and Sexes Combined)

Distribution and relative densities (harvest per land area unit) of the mourning dove harvest in the WMU (Table A-33) were calculated using direct recoveries (Table A-39) and land area weights (Table A-32).

Distribution

Arizona (41%) and California (32%) accounted for 73% of the estimated harvest in the WMU during 1967–75 (Table A-33). Oregon and Washington were next with 12 and 9%, respectively. With a combined total of only 6%, the States of Utah (3%), Nevada (2%), and Idaho (1%) were relatively minor harvest areas in the unit.

Density

The number of doves harvested per land area unit reflected almost identical harvest patterns as those for distribution. Arizona (97 birds per unit) had the highest harvest density, followed by California (55), Oregon (35), and Washington (34). Utah (9), Nevada (6), and Idaho (4) all had low harvest densities. In comparison, Missouri and Texas had the highest harvest densities in the CMU with 89 and 80, respectively; Colorado and New Mexico had the lowest, each with 12 (Dunks et al. 1982).

Composite Evaluation

As in the CMU, harvest pressure on mourning doves in the WMU was highest in the southern portion. Arizona and California exhibited the highest percentage of harvest, as well as the highest harvest densities per land area unit. Doves were lightly harvested in Utah, Nevada, and Idaho.

Distribution of Harvest in the Southern Zone of Doves Banded in the Western Management Unit

All Ages and Sexes Combined

There were 175 direct recoveries in the Southern Zone of doves banded in the WMU. Of these, 98% were recovered in Mexico and 2% in Central America (Table A-34). The predominant recovery location was the Western Highlands of Mexico, with 70% of the recoveries. Of the five States in this region, Jalisco (30%) and Michoacan (24%) were the major recovery recipients. The second most important recovery area was the Northwest Coast, with 22% of the total Southern Zone recoveries; Sinaloa (12%) and Baja California Norte and Sur (8%) were the States in this region with the greatest number of recoveries.

As expected, the Northern Highlands (5%), Northeast Coast (<1%), and Central Highlands (1%) of Mexico were minor harvest locations for mourning doves banded in the WMU. In addition, no doves were recovered in the Southern and Yucatan Peninsula regions and only two (2%) were recovered in Central America. WMU doves apparently follow the desert thorn scrub valleys of western Mexico to the Western Highlands where they winter.

The harvest pattern in the Southern Zone of doves from the WMU is similar to that of doves from the West tier of CMU States but substantially different from that of the Mid- and East-CMU tiers (Dunks et al. 1982). Doves from the two eastern CMU tiers are recovered in the Western Highlands in the same proportions as WMU doves (±70%), but a much larger proportion of Southern Zone recoveries is reported from the Central Highlands and Southern regions of Mexico and from Central America. This suggests that doves from the Mid- and East-

CMU tiers are more likely to migrate south of the Western Highlands than doves from the WMU.

Age Differences

Of the 175 direct recoveries in the Southern Zone, 147 were from immatures (Table A-35) and 28 from adults (Table A-36). Because of the small adult sample size, comparison of harvest distribution by age class was not practical. However, the absence of adult recoveries in the Southern Zone suggests that immatures are prone to migrate farther south than adults.

Composite Evaluation

Doves from the WMU follow a more westerly migration route into Mexico than doves from the CMU. Furthermore, they tend to winter farther north than CMU doves. However, the most important harvest region in the Southern Zone for all doves from the United States is the Western Highlands of Mexico.

Derivation of the Harvest

The delineation of breeding or natal areas for doves recovered in specific harvest areas is termed derivation of the harvest. In addition to harvest distribution, weighting factors (Table A-32) were also used to estimate derivation of the harvest.

Direct and indirect recovery derivation in the WMU varied by State of banding (Tables A-37 to A-42) as did direct recovery derivation in the Southern Zone (Tables A-43 to A-45). Only direct recoveries were used to illustrate derivation of the harvest; this treatment eliminates information from banded birds that did not return to the original breeding or natal area in succeeding years.

Derivation of the harvest was determined by age class for each WMU State and for each region of the Southern Zone. Derivation for the Southern Zone incorporates recoveries only from the WMU. For a discussion of total harvest derivation in Mexico and Central America, the reader is referred to Dunks et al. (1982).

Derivation—Western Management Unit
(All Ages and Sexes Combined)

With the exception of California and Arizona, hunters in the WMU States harvested doves (Table A-39) that primarily nested in or were hatched within the State of banding; that is, less than 10% originated from other States. Because California and Arizona are at the southern edge of the unit, it is not surprising that between 11 and 20% of their harvests came from other locations. For the WMU as a whole, about 98% of the harvest came from WMU States and <2% from the CMU. Those States with more than 2% of the harvest from the CMU (principally from Montana) were Idaho (7%) and Utah (3%). Idaho's figure is possibly biased upward as a result of low sample sizes. No direct recoveries in the WMU originated from the EMU.

Washington (n = 353)

The estimated harvest in Washington consisted almost entirely of birds that originated in the State (96%). About 3% of the harvest came from Idaho and 1% from Oregon. Doves from British Columbia and Alberta undoubtedly contributed to the kill in the WMU, but this contribution could not be estimated because of insufficient banding in Canada.

Oregon (n = 158)

All recoveries in Oregon were of doves banded in the State. Although nearly 9,000 birds were banded in Washington, it is noteworthy that no direct recoveries occurred in Oregon. This observation provides additional evidence that doves in the northernmost States overfly adjacent areas and make long initial flights to more southerly areas.

Idaho (n = 13)

Few recoveries were encountered in Idaho, due mainly to a small sample of banded birds. Of the estimated harvest in Idaho, 92% were from that State, 7% from Montana, and 2% from Washington.

Utah (n = 84)

Nearly 95% of the estimated harvest in Utah originated in the State. About 3% came from Montana and 2% from Washington.

Nevada (n = 68)

An estimated 91% of Nevada's dove harvest consisted of birds that originated in the State. States to the northwest accounted for more than 7% of Nevada's harvest (Washington 4% and Oregon 3%), and Arizona contributed 2%.

California (n = 1,124)

California had the largest estimated harvest in the WMU, with 81% coming from within State. More than 17% of the estimated harvest originated in other WMU States (Oregon 8%, Washington 3%, 2% each from Idaho, Nevada, and Arizona, and 1% from Utah). Less than 2% came from the CMU; however, this figure represented contributions from six different CMU States.

Arizona (n = 919)

Although an estimated 89% of Arizona's harvest was of birds from that State, doves from 13 other States also

contributed to the kill. About 9% of the harvest came from other WMU States, predominantly Utah 3%, Nevada 2%, and California 2%. Seven CMU States contributed a combined 2%, with Montana, Wyoming, and Colorado being most prominent.

Derivation—Southern Zone
(All Ages and Sexes Combined)

Derivation of harvest data, based on direct recoveries in the Southern Zone from all doves banded in the WMU, are summarized in Table A-45. Small sample sizes prevented detailed comparisons for most regions.

Mexico (n = 173)

Dunks et al. (1982) reported that, of 902 direct recoveries in Mexico from doves banded in the United States between 1967 and 1975, 75% originated in the CMU, 23% in the WMU, and <2% in the EMU. In the present study, 173 direct recoveries from the WMU were in Mexico. Of these, nearly half came from California (29%) and Arizona (19%). The rest were distributed among the other WMU States, with no discernible pattern. Doves from all WMU States migrate in some numbers to Mexico.

Region 1—Northwest Coast (n = 39). Many doves from all WMU States apparently pass through this region on their southward migration. California (with 37%) was the greatest contributor to the harvest, but Arizona (19%) and Oregon (17%) also were prominent originating areas. Baja California received birds from the East-WMU States as well as from the West-WMU, perhaps in the extensive farming communities along the Colorado River near Mexicali.

Region 2—Northern Highlands (n = 5). This region was represented by the State of Zacatecas, with one recovery from each of five WMU States. No harvest patterns can be determined here.

Region 3—Northeast Coast (n = 1). One bird from Utah was recovered in Coahuila, reflecting the general lack of recoveries east of mid-central Mexico.

Region 4—Western Highlands (n = 126). Most of the dove recoveries in Mexico from the WMU were reported from this region. Although California (28%) contributed more than any other WMU State, all were well represented. This region appears to be a major wintering area for WMU doves.

Regions 5–7—Central Highlands, Southern, and Yucatan Peninsula (n = 2). Only two recoveries were reported from this vast area of Mexico, which further indicates that doves from the WMU migrate south along west coast Mexican States to winter in the Western Highlands.

Central America (n = 2)

Only two doves banded in the WMU States of Idaho and Utah were recovered in Central America (Guatemala and Honduras, respectively) and no derivation patterns could be identified.

Sex and Age Differences in Derivation of Harvest

Western Management Unit—Adult Males Versus Adult Females

Derivation data for adults were examined separately by sex, but small sample sizes made comparisons imprecise. Nevertheless, estimated contributions to State harvest were similar for males and females. Nearly 99% of the WMU harvest for each sex came from within the unit and about 1% from the CMU (data by sex class is not presented in tabular form). Although the proportions of recoveries varied by State, the general pattern in each was similar for each sex.

In three of the seven WMU States, the proportion of adult female recoveries that originated within the State of recovery was lower than that for males (Table A-46). The remaining four States had identical in-State contributions for males and females. At least for Arizona, it appears that males may delay the onset of fall migration until after females.

Southern Zone—Adult Males Versus Adult Females

Only 17 adult males and 8 adult females were recovered in known locations (Tables A-15 and A-16) in the Southern Zone and no comparisons could be made.

Western Management Unit— Adults Versus Immatures

Within each WMU State, derivation patterns were similar for adults and immatures (Tables A-37 and A-38). No age differences could be detected.

Southern Zone—Adults Versus Immatures

Sample size of the adult cohort in the Southern Zone was too small to make comparisons between adults and immatures.

Chronology of Migration

Knowledge of the timing of fall migration by mourning doves can be useful in setting annual hunting regulations. Studies using roadside counts of doves in the WMU have documented that dove populations are at peak numbers in late July and early August and initiate migration by late August (Smith 1970; Miles 1976). However, because of simultaneous ingress and egress from the areas

studied, roadside counts do not provide specific information on chronology of migration. Dunks et al. (1982) examined the relative proportions of dove recoveries in Texas by 10-day periods to determine migrational timing in the CMU. This procedure largely compensated for the problem of ingress and egress and allowed estimates of the relative number of birds entering a southern harvest area from each contributing area. The same procedure was used in this study.

Chronological Changes in Origin of Doves Harvested in Arizona and California

Because Arizona and California are southern harvest areas with recoveries originating from all States of the WMU and several States of the CMU, they were selected for examination of chronological derivation. The origins of doves in each State were calculated for each 10-day period in September and for the entire month of October (Tables A-47 through A-52). These data were stratified by age of bird banded and weighted as explained earlier. Only direct recoveries were used. Because of relatively small sample sizes in both States, particularly after the first 10-day period, this exercise was not as productive as anticipated. However, some general trends were noted and compared with those obtained from Dunks et al. (1982).

Arizona—All Ages and Sexes Combined

1–10 September. During the first 10 days of September, an estimated 91% of the harvested doves originated within Arizona (Table A-47). Utah, California, Nevada, and Idaho each contributed between 1 and 2% for a total of 6%, and Washington and Oregon collectively provided 1%. Seven States of the CMU contributed a total of 2%.

11–20 September. During the second 10 days of September, only 73% of the estimated harvest originated within Arizona, whereas 24% came from other WMU States—each individually contributing between 1 and 6%. Montana and Colorado from the CMU contributed a combined 3%.

21–30 September. A small sample size in late September precluded estimation of derivation. Note, however, that all three out-of-State recoveries came from the northern CMU States of Montana, North Dakota, and South Dakota.

1–31 October. The hunting season was generally closed in Arizona during October. The few out-of-State recoveries came from California and Colorado.

Arizona—Adults and Immatures

The origins of immatures and adults recovered in Arizona were similar (Tables A-48 and A-49). The proportion of harvested doves that originated in Arizona showed a general decline by time period. During the four periods, the estimated percentages of harvested doves originating in Arizona were 93, 68, 77, and 50 for immatures and 90, 76, 62, and 100 for adults. For both age classes, a higher estimated percentage of the harvest came from other locations to the north during 11–20 September. However, it is noteworthy that all six of the other WMU States and seven CMU States contributed to Arizona's harvest during 1–10 September. Although this varied somewhat by age category, the pattern was evident for both immatures and adults. Thus, migration from more northern areas by both cohorts apparently had been initiated by late August.

California—All Ages and Sexes Combined

1–10 September. Doves that originated in California composed an estimated 83% of the harvest during the first 10 days of September (Table A-50). Oregon accounted for 6% and all other WMU States each contributed between 1 and 2%. Five CMU States contributed a combined percentage of slightly more than 1%.

11–20 September. The proportion of harvested doves originating in California decreased to 63% in mid-September. Washington (10%) and Oregon (20%) had now contributed 30% of the harvest. Montana, Colorado, and Nevada each contributed between 2 and 3%.

21–30 September. By late September, Washington (14%) and Oregon (36%) accounted for half of California's estimated harvest; most of the rest originated in California (48%). The reader is advised, however, that the small sample size (20 recoveries) may have resulted in a distorted impression of Washington and Oregon's contribution.

November and December. Between 1968 and 1975, California had a 16-day hunting season during the last week of November and the first week in December. During that time, an estimated 76% of the harvested doves originated from California; the only other WMU State that contributed to the harvest was Oregon, with 13%. Montana and Minnesota contributed a combined total of 11%. The information for this period suggests that a portion of the doves from the north had passed through California and that the late hunting season sampled birds that were produced in the State.

California—Adults and Immatures

Although sample sizes of banded doves harvested in California are low, the origins for both immatures and adults were similar (Tables A-51 and A-52). The estimated

proportions of harvested doves originating in California for the four 10-day periods were 82, 58, 53, and 74 for immatures and 82, 74, 43, and zero (no sample) for adults. For both age cohorts, relative contributions from Washington and Oregon increased during the 11–20 and 21–30 September periods. As in Arizona, all States of the WMU and several States from the CMU contributed doves to California's harvest during 1–10 September, suggesting that mourning doves begin migration in late August and early September.

Composite Evaluation

During the first 10 days of the hunting seasons in Arizona and California, hunters mainly harvested doves that nested or were reared in those States. However, all States in the WMU contributed a small proportion of the birds harvested during that time period, suggesting that migration begins throughout the unit before the hunting season begins. By 11–20 September, doves originating from the southern harvest areas became less prevalent and those from other WMU States contributed more to the harvest there. By 21–30 September, doves from Washington and Oregon formed a large proportion of the harvest in California. In Arizona during that period, doves from Montana, North Dakota, and South Dakota constituted an important contribution to the harvest. Hunting seasons were generally closed in Arizona and California during October and the data for that period were inconclusive.

During the late California hunting season in November and December, locally produced doves were again prominent in the harvest, suggesting that many birds from the north had passed through the State into Mexico by that time. These findings are consistent with those of Dunks et al. (1982) for doves harvested in Texas.

Chronology of Recoveries in Mexico

The chronology of direct recoveries in Mexico was examined for doves banded in the WMU during 1967–75. Chronological recovery patterns were used to depict the timing of hunting pressure and to approximate arrival dates. We recognize that hunting seasons in Mexico during this period were not uniform and for several years did not open until after September. However, because hunting is not necessarily confined to the official season, we believe that recovery dates generally represent the arrival patterns of doves from the WMU.

Ten-day periods in which direct recoveries from WMU States were reported in Mexico were tabulated for adult and immature doves (Table A-53). Of the 26 recoveries of adults and 147 of immatures, 24 (92%) and 133 (90%), respectively, were identifiable to the 10-day period of recovery. Because of the small sample size, no recovery patterns could be discerned for the adult cohort. Surprisingly, 3 of the 24 adult recoveries occurred in August, whereas the immature segment began to arrive during early September. There was a marked increase of immature recoveries during 11–20 October. Recoveries during this period were 3 times that of 1–10 October and the number remained high for each period through 11–20 November. After that, the number of recoveries decreased to an average of about four recoveries through 1–10 April and then tapered to 1.5 or fewer recoveries per period thereafter. Dunks et al. (1982) noted an almost identical pattern for recoveries of CMU-banded birds recovered in Mexico, thus suggesting that the arrival of WMU and CMU doves in Mexico is simultaneous. Recoveries rose sharply for both cohorts during 11–20 October, by a factor of 3. This period probably marks the peak arrival time for U.S.-produced doves in Mexico.

Spring migration dates can also be predicted. Immature recoveries from both the WMU and CMU decreased markedly in Mexico after 1–10 April. Adult dove recoveries from the CMU began to decrease by 11–20 March but did not decline markedly until 21–30 April. These data suggest that mourning doves begin leaving Mexico in late March and are in full migration by mid-April.

Survival and Recovery Rates

General

As in Dunks et al. (1982), we analyzed the WMU data for survival and recovery rate estimates using methods described by Brownie et al. (1978). These stochastic models allow computation of sampling variances for individual estimates.

Several problems are associated with estimating survival and recovery rates from mourning dove bandings. The first is that doves have a low rate of recovery and an uncommonly large number of birds must be banded to provide an adequate sample size. In the WMU, sample sizes were low for several States, and estimates were therefore subject to high sampling error. A second problem was the inability of banders to determine the sex of most immature birds because of unreliable plumage characteristics. These birds must either be analyzed as a pooled sample of unknown-sex immatures or discarded and not used. Because there may be sex differences in survival or recovery rate, the pooled sample could yield misleading estimates. The only way to test whether differences exist is to test the adult sample for sex differences and assume either that the results also apply to immatures

or, if they do not, that heterogeneity of survival and recovery rates can be detected by goodness-of-fit tests. If it is suspected that there are indeed substantial sex-specific differences in survival or recovery rates within the immature cohort, then these rates should not be estimated by program BROWNIE. A third problem occurs when banders mis-age some of the doves trapped. For mourning doves, early hatched immatures lose their diagnostic primary coverts and can be classified as adults by inexperienced banders. This can result in a heterogeneous "adult" sample with respect to survival and recovery rates. Because this violates an important assumption of the models, resulting estimates of survival and recovery rates will likely be biased (see Nichols et al. 1982; Pollock and Raveling 1982). Mis-aging may have occurred in Arizona during 1968, 1970, and 1972.

The original analysis of survival and recovery rates for WMU data from 1967 to 1975 yielded imprecise or no estimates for most States because of small sample sizes. We later learned that most States in the WMU had participated in a mourning dove banding program for 3 years before the nationwide program and that considerably more data were available. Accordingly, the Bird Banding Laboratory was asked to provide the additional information. We reanalyzed the expanded data base for bandings and recoveries (1964–74) and report the results here.

For our initial examination, we used two types of tests, a chi-square contingency test and a z-test (Brownie et al. 1978) to determine if adult males and adult females had similar survival and recovery rates. The chi-square test statistic for Arizona was highly significant ($P < 0.01$), as was the composite statistic for all areas combined (Table A-54). However, the composite statistic was influenced heavily by the Arizona statistic. We concluded that recovery or survival rates were definitely different for Arizona-banded adult males and females, but withheld judgment about the rates of other States pending results of further tests.

We then examined survival and recovery rates separately by a series of z-tests, using adult parameters in Tables A-57 and A-58. The only significant difference ($P < 0.01$) was that adult males had a higher recovery rate than adult females in Arizona (Table A-55). Average recovery rates were similar for both sexes in all other States and the tests had reasonable power to detect differences of interest. Although the composite statistic was significant ($P < 0.05$), it depended heavily on the large difference observed for Arizona. In addition, the direction of differences was not consistent among States. The Arizona estimates of both recovery and survival rates were obtained using Model 0 of Brownie et al. (1978). This model assumes that recovery rates of adults the first year of banding are different from recovery rates of doves banded in previous years. It was suspected that the first-year recovery rate difference between adult males and females in Arizona may have resulted from mis-aging. However, recovery rates after the first year were 6.0% for males and 1.8% for females and the difference was significant ($P < 0.01$). We conclude that adult males in Arizona actually are recovered at a higher rate than adult females. Although several factors could be responsible, the difference may be due to a differential migration pattern as suggested by data in Table A-46. If this premise is correct, adult males remain in Arizona longer than females and are thus subjected to longer and more intensive hunting pressure.

For adult survival rates, no significant differences between sexes were detected among the WMU States (Table A-55). Although the power of these tests was low, the composite test statistic and the absence of consistent differences among point estimates provided no evidence of sex-specific adult survival rate differences.

Thus we conclude that, except for Arizona, data for both sexes could be pooled to obtain survival and recovery rate estimates from immature data using the 2-age models of Brownie et al. (1978). We caution, however, that if an actual substantial sex-specificity was undetected, then resulting estimates could be misleading.

Tests (Brownie et al. 1978) also were conducted to determine if data from different States were similar and could be pooled to obtain larger data sets (e.g., coastal and interior States; Table A-56). The tests suggested that survival or recovery rates of adult doves exhibited substantial geographic variation and that pooling would not be warranted.

Estimated Survival and Recovery Rates

During the following discussion, the reader should be aware that average survival and recovery rate estimates from each State were not necessarily obtained from the same span of years, although the overall span was the same (1964–74). In a few instances, two estimates were derived from separate time periods for a single State. In addition, confidence intervals are wide for many estimates and should be viewed carefully in evaluating the survival and recovery rates presented.

Adult Males

Survival and recovery rates for adult males were calculated for all WMU States except Oregon (inadequate sample) using program ESTIMATE (Table A-57). Male doves from Utah had the highest estimated survival rate

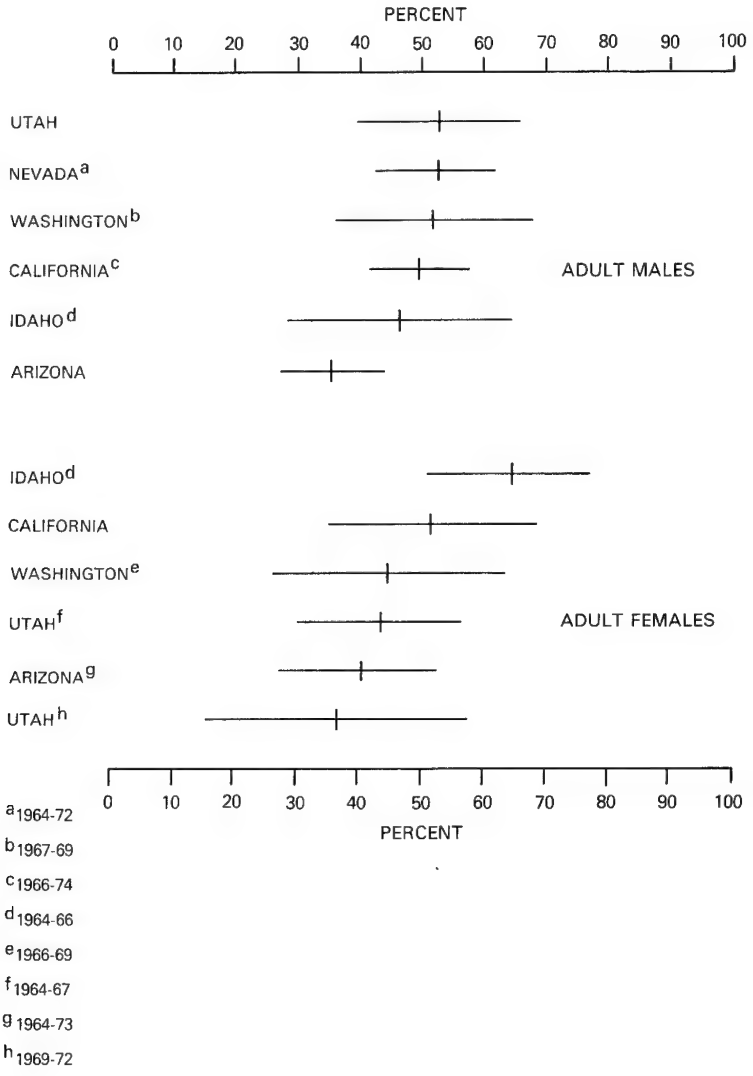

Fig. 17. Estimated mean annual survival rates (95% confidence intervals) of adult male and female mourning doves banded in the Western Management Unit, 1964–74.

(52.7%) and those from Arizona the lowest (35.5%; Fig. 17). The average unweighted survival rate estimate for the unit was 48.0%. Estimated recovery rates ranged from 1.3% for birds banded in Utah to 5.1% for doves from Arizona; the unweighted WMU average was 2.7%.

Adult Females

The data sets for adult females in each State had generally lower sample sizes than those for other age and sex cohorts. However, estimates of survival and recovery rates were obtained using program ESTIMATE in selected years for doves in five of the seven States of the WMU (Table A-58). Female doves from Idaho had the highest estimated survival rate (64.1%) whereas those from Utah had the lowest (36.9%; Fig. 17). The unweighted average survival rate estimate for the WMU was 47.0%. Estimated recovery rates ranged from 0.9% in Utah (1969–72) to 3.8% in California; the unweighted unit average was 2.3%.

Adults and Immatures

Survival and recovery rates were also estimated for adult and immature doves (sexes combined) for six of the seven WMU States using program BROWNIE (Tables A-59 and A-60). Because of strong evidence of sex-specificity for data from Arizona described earlier, and because sex of most immature doves cannot be accurately identified in the field, estimates were not calculated for that State. Results in Table A-61 formally

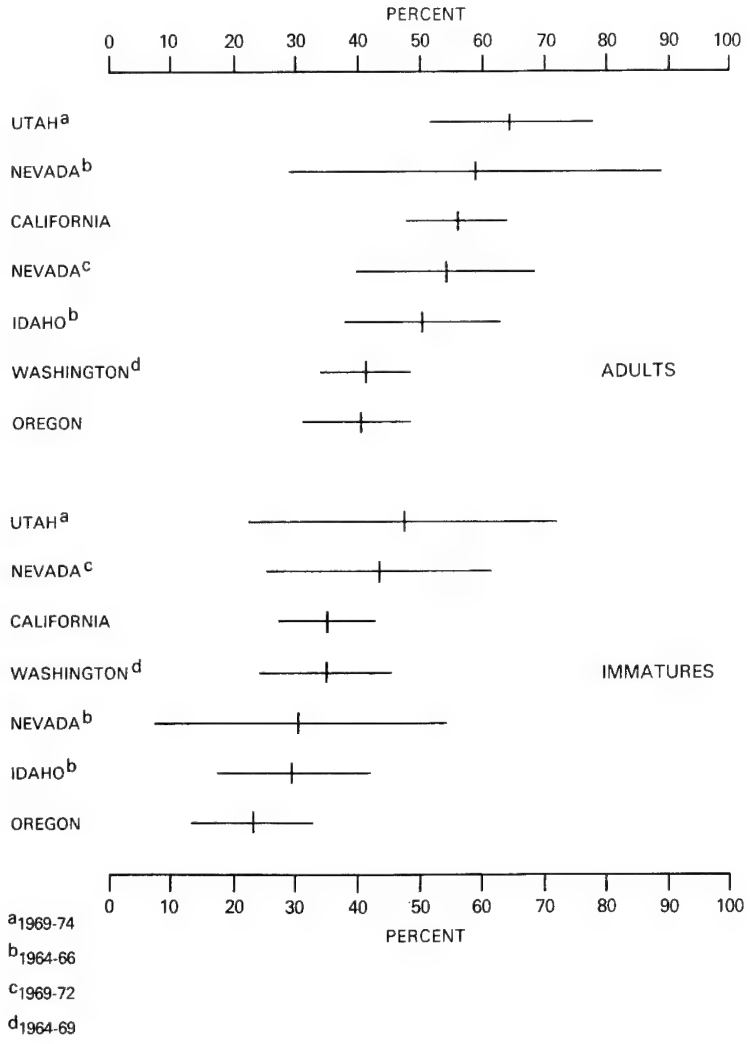

Fig. 18. Estimated mean annual survival rates (95% confidence intervals) of adult and immature mourning doves banded in the Western Management Unit, 1964–74.

address the hypothesis that young and adult birds exhibit similar survival and recovery rates (see Brownie et al. 1978). The general lack of fit of H_0 and the significant H_0 versus H_1 test statistics provide strong evidence that survival or recovery rates do vary age-specifically for WMU doves.

The unitwide unweighted average survival rate estimates for adult and immature doves were 52.4 and 35.0%, respectively. For both age cohorts, birds banded in Utah and Oregon had the highest and lowest survival rates, respectively (Fig. 18).

The unweighted average recovery rate estimates for adult and immature doves banded in the WMU were 2.2 and 3.2%, respectively. Adult doves from Washington had the highest recovery rate (3.9%) and those banded in Nevada had the lowest (0.7%). Immature doves from Oregon had the highest recovery rate (5.7%) and those from Utah had the lowest (1.0%).

Composite Evaluation

Although earlier testing showed considerable variation among States and precluded the pooling of data, some general conclusions can be made for the unit. Excluding data from Arizona, average survival rates seem to be about 50% for adults and 35% for immatures. Similarly, the average recovery rates are about 2.2% for adults and 3.2% for immatures. In comparison with the CMU (Dunks et al. 1982), the WMU had lower point estimates of survival (50% vs. 53% for adults and 35% vs. 44% for immatures) and higher estimates of recovery rates

(2.2% vs. 1.5% for adults and 3.2% vs. 2.0% for immatures).

Geographic Differences

North Versus South Survival

Dunks et al. (1982) found that, in the CMU, survival rates were significantly higher for doves banded in nonhunting northern States than for doves banded in southern hunting States. They cautioned, however, that this result possibly could have reflected geographical differences in overall mortality unrelated to hunting. Because all States in the WMU permitted dove hunting during the study period, similar tests between hunting and nonhunting States could not be performed in this analysis. However, superficial observation of data (Fig. 18) suggested that differences in survival between north and south may have existed during the study period. We used z-tests to further examine the adult and immature survival rate estimates (Tables A-59 and A-60) to test whether differences could be detected between average survival rates of doves from northern States (Washington, Oregon, and Idaho) and southern States (California, Utah, and Nevada). Estimated survival rates of adult doves in the north (average, 44.2%) were significantly ($P < 0.01$) lower than those of adults in the south (58.2%). Similarly, immature doves from the north had significantly lower ($P < 0.05$) survival rates (29.4%) than those from the south (41.9%). These results provide some evidence of differences in survival rates between northern and southern parts of the WMU. However, the differences are in the opposite direction from that determined from the CMU study, that is, dove survival in the northern WMU is generally lower than that for the south (except for doves from Arizona), whereas in the CMU survival is higher in the northern nonhunting portion than the southern hunting portion.

Coastal Versus Interior Survival

Estimated survival rates of adults and immatures in interior States (Idaho, Nevada, and Utah) and those in coastal States (Washington, Oregon, and California) were also compared using z-tests. For adults, the average estimated survival rate of 46.0% in coastal States was significantly lower than the average rate of 57.1% in interior States ($P < 0.05$). However, although the average survival rate estimate for immatures was also lower in coastal States (31.1%) than in interior States (37.9%), the difference was not significant ($P > 0.05$). Because considerable individual State variation occurred, particularly for the immature cohort, a definitive conclusion about interior versus coastal survival rates could not be made.

Composite Evaluation

The data in this study suggested that mourning dove survival in northern and coastal areas of the WMU is lower than in southern and interior areas. However, because of the variation in the estimated survival rates among States, the apparent differences could be due to chance and therefore unrelated to latitudinal or other geographic conditions. Nevertheless, the latitudinal differences in survival detected in the WMU under ubiquitous hunting regulations were opposite to differences in the CMU where hunting was allowed in southern States and not in most northern States. Therefore, we suggest that the higher dove survival in the north CMU as reported by Dunks et al. (1982) probably was not a function of latitudinal factors.

Coastal Versus Interior Recovery Rates

Recovery rates of doves banded in the WMU varied widely among States. Examination of the data in Tables A-59 and A-60 suggested that doves banded in coastal States (Washington, Oregon, and California) had different recovery rates than those banded in interior States (Idaho, Nevada, and Utah). With the addition of direct recovery rates from Arizona (interior), the means of average State recovery rate estimates were investigated by z-tests for possible differences between the two regions. Recovery rates for both age cohorts were significantly higher ($P < 0.01$) in coastal areas than in interior areas. These differences are consistent with geographic differences in relative harvest density (Table A-33).

Doves from interior States generally emigrate through high-altitude desert areas of sparse human population at a greater rate than doves from the lower coastal region with greater human population (Miles 1976). Perhaps the longer exposure to hunting in coastal States is at least partially responsible for higher recovery rates there. Tomlinson (1968) concluded that a high reporting rate caused inflated recovery rates in Washington. It is conceivable that high reporting rates in Washington and Oregon were responsible for the higher recovery rates for those States during the study period.

Sample Sizes Necessary for Future Banding Programs

Although a survival rate estimate is one of many parameters obtained from banding programs, it is one of considerable application. The WMU mourning dove survival rate estimates presented here are not as precise as biologists would prefer for management decisions. The relatively low band recovery rates of mourning doves necessitate large banded sample sizes to achieve estimates with better precision. To provide reliable estimates from any future banding program, we have computed banded

sample size requirements necessary under predetermined conditions (Table A-62). In these computations, a desired coefficient of variation for the mean annual adult survival rate $[\widehat{CV}(\hat{\bar{S}})=\widehat{SE}(\hat{\bar{S}})/\hat{\bar{S}}]$ has been specified. We computed annual banded sample size requirements using different combinations of hypothetical survival and recovery rates according to the methods of Brownie et al. (1978). Sample sizes (Table A-62) correspond to $\widehat{CV}(\hat{\bar{S}}) = 0.06$, which yields an approximate 95% confidence interval of width 0.05–0.07 for the hypothetical survival rates. The computed banded sample sizes pertain to adults only and would be required each year by each State for a prospective banding program. For example, with an expected recovery rate of 3% and a survival rate of 40%, each State would have to band 2,900 adults annually in a 5-year program (or 900 in a 10-year program). Estimation of immature survival rates (S') with similar precision $[\widehat{CV}(\hat{\bar{S}}') = 0.06]$ would require larger banded samples of both young and adults. In addition, much larger samples would be required to estimate annual survival rates in specific years with comparable levels of precision. Any future banding program should be considered carefully to ensure that the most useful data are obtained for the efforts involved. Early development of a clear definition of objectives and a sampling design consistent with the objectives is necessary for a successful conclusion to the program.

Life Equation

Dunks et al. (1982) related mortality to recruitment and determined that the annual production required to maintain a stable breeding population in the CMU was 2.2 young per pair of breeding adults. In this study, we computed the production that was necessary to balance mourning dove mortality in the WMU (Table A-63). This exercise assumed that survival and production rates remained constant over time. The production requirement ranged from 1.6 (Utah) to 5.2 (Oregon) young per pair of breeding birds and averaged 2.8 for the WMU as a whole. This reflects the somewhat lower survival rates of immature doves in the WMU in comparison with the CMU.

Mourning dove productivity in the WMU has been reported in three studies. The average number of fledglings produced per pair of doves was 6.2 in California (Cowan 1952), 3.9 in Utah (Dahlgren 1955), and 3.2 in Idaho (Fichter 1959). Recognizing that conditions may have changed since the 1950's, and that dove populations exhibit temporal variation in both survival and productivity, we nonetheless conclude that a production requirement of 2.8 young per pair was met in the WMU during the period of this study.

Differential Vulnerability

In the WMU, direct recovery rates for immatures were consistently higher than those for adults, signifying differential vulnerability between age classes. Relative recovery rates (ratios of immature to adult recovery rates) were calculated for each State in the WMU and averaged for the unit (Table A-64). The relative recovery rates varied from 0.96 for Idaho to 1.53 for Washington among WMU States. Excluding data from Idaho (small sample sizes), the average relative recovery rate for the WMU was 1.3. This was the identical rate derived from CMU bandings (Dunks et al. 1982). Thus, immatures were slightly more vulnerable than adults to hunter harvest. This value can be applied to age ratios obtained from hunting season wing collection surveys to estimate the true preseason proportions of young to adult mourning doves throughout both management units.

Proportion of Population Removed by Hunting

Mourning doves were hunted in all seven States of the WMU during the study period and an average of >7 million birds were harvested annually. Kill rates for adult and immature doves in the WMU during 1967–75 were calculated by adjusting recovery rates to compensate for reporting rate and crippling loss (Table A-65). A reporting rate of 32% (Tomlinson 1968) was used instead of the 45% reported by Reeves (1979) and used by Dunks et al. (1982) for similar calculations, because the former was believed to more closely reflect conditions in the WMU. A crippling rate of 30% was incorporated as indicated by Haas (1977) and several earlier authors.

The estimated kill rates for adult and immature mourning doves from the WMU were 9.9 and 14.3%, respectively. These rates compare with 4.7 and 6.3% for adults and immatures from the CMU (Dunks et al. 1982). The estimated proportions of total mortality (47.6% for adults and 65% for immatures) due to hunting in the WMU were 20.8 and 22.0%, respectively (Table A-65; Fig. 19). We wish to caution the reader, however, that knowledge of these estimates does not permit inferences about whether variation in hunting mortality rate contributes to a corresponding variation in total annual mortality rate. Although the kill rate level that will adversely affect mourning dove populations is unknown, it is believed that the rates of 10–15% in the WMU were probably well below the critical level.

Indirect Population Estimates

The mourning dove is one of the most abundant species of bird on the North American continent. Comprehensive breeding bird surveys conducted in the United States and

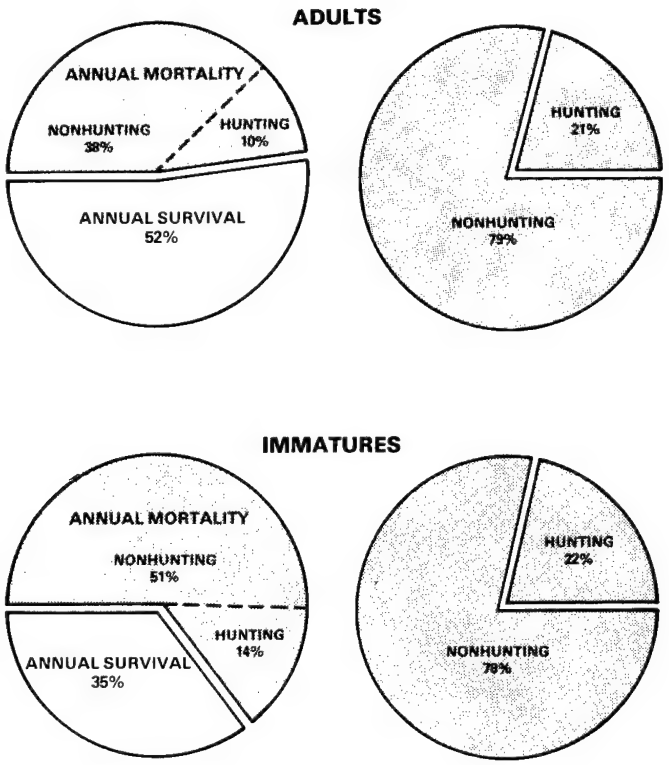

Fig. 19. Relation of hunting mortality to total annual mortality of mourning doves in the Western Management Unit, 1964–74.

Canada during 1967 and 1968 (Robbins and Van Velzen 1969) indicated that the numbers of mourning doves were exceeded by only five other species surveyed. Call-count data are used to compute annual indices of mourning dove breeding population size (Dolton 1977), but actual estimates of population size cannot be obtained from these data. However, mourning dove populations can be estimated indirectly by employing harvest and banding data in conjunction with the Lincoln-Petersen capture–recapture estimator.

Dunks et al. (1982) used such a method to obtain an estimate of total fall-flight population size of mourning doves in each of the management units and the United States from data obtained for the CMU. Their calculations produced estimates of 476 million doves in the United States, of which 120 million were from the EMU, 265 million from the CMU, and 91 million from the WMU. The method used in their analysis was suggested by Lincoln (1930) and also used by Dunks (1977) to project mourning dove populations in Texas (see also Geis 1972). This computation relies on estimates of two quantities. First, banding and recovery data are used to estimate proportion of the total population killed by hunters. State harvest survey data are then used to estimate the magnitude of the harvest. Population size is estimated by dividing the second estimate by the first.

In the Dunks et al. (1982) analysis, the indirect population estimates were derived from harvest figures for five of the 14 States because the others did not conduct harvest surveys or had no open dove seasons. Estimates were derived separately from each of the five States and averaged for the final U.S. projection.

For the present study, all seven WMU States conducted harvest surveys during the study period. The average harvests in each State from 1967 to 1976 (Table A-3) were combined at the outset to make population projections. As observed by Dunks et al. (1982), indirect fall-flight estimates are strongly dependent on an accurate estimate of band reporting rate. For the CMU projection, a band reporting rate of 32% was used (Tomlinson 1968). Although band collecting in the WMU probably resulted in a higher reporting rate than in the CMU (Table A-7), we elected to use the same rate (32%) in our calculations for consistency between the two studies. If reporting rate was indeed greater in the WMU, the projected population estimate would be higher. Our population projection yielded a fall-flight estimate of 76 million doves in the WMU and 470 million for the entire Nation (Table A-66).

The U.S. estimate corresponds closely to the Dunks et al. estimate of 476 million and falls within the 350 to 600 million bird range derived from data from each of the five States of the earlier study. We believe that 475 million mourning doves is a conservative and reasonable estimate of the U.S. population. As in Dunks et al. (1982), we caution the reader that the estimate is based on broad assumptions, some of which could be erroneous. Nevertheless, these exercises confirm that mourning dove populations in the United States are substantial.

Summary

1. More than 868,000 mourning doves were banded in the United States between 1967 and 1975; 88,540 of these were banded in the WMU.
2. Of 31,900 adults banded in the WMU and identified by sex, the sex ratio of males to females was 145:100; the overall age ratio of immatures to adults was 171:100.
3. Of 2,859 direct recoveries from WMU bandings, 2,668 (93%) were taken in the WMU, 178 (>6%) in the Southern Zone, 13 (<1%) in the CMU, and none in the EMU.
4. The proportion of direct recoveries occurring in State of banding was high for Arizona, California, Washington, and Oregon (75–95%), moderate for Utah and Nevada (53–55%), and low for Idaho (37%).
5. The pattern of migration for doves banded in the WMU is generally straight south. Little tendency was noted for doves to move eastward into the CMU.
6. Doves banded in the WMU and CMU have equal probabilities of being recovered in Mexico, but doves from the CMU are 13 times more likely to be recovered in Central America.
7. Generally, doves banded in northern portions of the WMU and CMU have a higher probability of being recovered in the Southern Zone than doves banded in southern parts of those units.
8. Immature doves either migrate earlier or are more likely to migrate than adults.
9. Three-fourths of the WMU dove harvest occurred in Arizona (41%) and California (32%). These two States also had the highest harvest per land unit area.
10. Of doves originating in the WMU and harvested in the Southern Zone, 98% occurred in Mexico and 2% in Central America.
11. Of doves originating in the WMU and harvested in Mexico, 70% occurred in the Western Highlands and 22% in the Northwest Coast Region. All other regions of Mexico were unimportant harvest areas.
12. The southern terminus for doves migrating from the WMU is substantially farther north in Mexico than for doves from the CMU.
13. The harvest in most WMU States consists mainly of birds that nested or were hatched in those States (i.e., >90%). However, California and Arizona each had recoveries from 13 other States for 19 and 11% of their harvests, respectively.
14. Of the total dove harvest in the WMU, 98% originated from within the WMU; the remaining 2% originated from the CMU.
15. Of doves originating in the WMU and harvested in Mexico, nearly half came from California and Arizona. Doves from all WMU States contributed to the harvest in Mexico, but no definitive patterns were discerned.
16. Migrating doves from all States of the WMU and several States of the CMU arrived in Arizona and California by the first 10 days of September. By mid-September, northern arrivals had increased substantially in both States. By 21–30 September, doves from Washington and Oregon formed a large proportion of the harvest in California. By November–December, locally-produced doves were again prominent in California's harvest, suggesting that birds from the north had passed through the State.
17. The peak period of fall arrival for WMU mourning doves in Mexico is 11–20 October, the same as for doves from the CMU.
18. Spring departure from Mexico begins in late March and migration is in full progress by mid-April.
19. Recovery and survival rate estimates for several States in the WMU were based on small sample sizes and, therefore, subject to high sampling error. As an aid to planning for future banding programs, the estimated annual banding sample sizes necessary to achieve a coefficient of variation of 0.06 at different combinations of expected adult survival and recovery rates are provided.
20. Mourning dove recovery and survival rates varied from year to year.
21. Except for Arizona, no differences in either recovery or survival rates were detected between adult males and adult females. Adult males from Arizona had a higher recovery rate than adult females.
22. The unweighted average recovery rates for doves banded in the WMU were 2.2% for adults and 3.2% for immatures.
23. The unweighted average survival rates for doves banded in the WMU were 52.4% for adults and 35.0% for immatures.
24. Mourning dove survival seemed to be lower in north-

ern and coastal areas than in southern and interior areas of the WMU, although the differences may have been due to coincidental factors unrelated to geographic conditions.
25. Coastal States of the WMU had higher recovery rates than interior WMU States.
26. A production rate of 2.8 young per pair of breeding adults was needed to compensate for annual mortality to maintain a constant breeding dove population in the WMU, assuming that survival and production rates remained constant over time.
27. Immature doves had higher direct recovery rates and were thus more vulnerable to hunter harvest than adults. The average relative recovery rate for the WMU was 1.3 immatures per adult, identical to that for the CMU.
28. The kill rates for adult and immature mourning doves were 9.9 and 14.3%, respectively. Therefore, the estimated proportion of total mortality (47.6% for adults and 65.0% for immatures) due to hunting was 20.8 and 22.0%, respectively.
29. The average fall flight population of mourning doves for the 48 conterminous States was estimated to be 470 million birds.

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Appendix A. Western Management Unit Mourning Dove Banding Analysis, 1967–1975 (Tables A-1 through A-66)

The large number of tables provided in this report enables readers to use the information for making detailed analyses of data for smaller areas or for different combinations of States than provided. We have placed all of the tables in one appendix to allow readers to quickly find specific data. We believe that this treatment is more convenient than interspersing tables throughout the text. The acronyms EMU, CMU, and WMU refer to Eastern, Central, and Western Management Units, respectively. Mexico and Central American countries collectively are termed the Southern Zone. This zone is divided into eight regions, each having distinct characteristics for migratory doves.

Table A-1. Relative abundance of mourning dove breeding populations by management unit in the United States, 1967-75.[a]

Breeding area	Land area weight[b]	Mean no. of doves per route	Breeding population index	Relative abundance[c]
West-WMU				
Washington	43.87	8.12	356.22	1.0
Oregon	62.27	8.88	552.96	1.5
Nevada	71.27	4.92	350.65	1.0
California	101.71	13.64	1,387.32	3.9
Subtotal	279.12 (14.5)		2,647.15	7.4
East-WMU				
Idaho	54.37	11.81	642.11	1.8
Utah	53.34	15.69	836.90	2.3
Arizona	72.65	23.34	1,695.65	4.7
Subtotal	180.36 (9.4)		3,174.66	8.8
WMU total	459.48 (23.9)		5,821.81	16.2
West-CMU				
Montana	94.47	10.98	1,037.28	2.9
Wyoming	62.33	10.41	648.86	1.8
Colorado	67.18	14.93	1,003.00	2.8
New Mexico	77.98	11.35	885.07	2.5
Subtotal	301.96 (15.7)		3,574.21	10.0
Mid-CMU				
North Dakota	45.54	24.45	1,113.45	3.1
South Dakota	49.20	37.72	1,855.82	5.2
Nebraska	49.69	40.27	2,001.02	5.6
Kansas	52.43	55.22	2,895.18	8.1
Oklahoma	44.40	31.29	1,389.28	3.9
Texas	170.03	19.31	3,283.28	9.1
Subtotal	411.29 (21.4)		12,538.03	34.9
East-CMU				
Minnesota	54.09	13.71	741.57	2.1
Iowa	36.15	28.52	1,031.00	2.9
Missouri	45.10	31.70	1,429.67	4.0
Arkansas	34.37	23.32	801.51	2.2
Subtotal	169.71 (8.8)		4,003.75	11.1
CMU total	882.96 (46.0)		20,115.99	56.0
EMU				
Maine	19.85	0.25	4.96	Tr
Rhode Island	0.67	9.42	6.31	Tr
Massachusetts	5.31	6.81	36.16	0.1
New Hampshire	5.80	4.04	23.43	0.1
Vermont	5.95	1.33	7.91	Tr
New York	30.49	10.24	312.22	0.9
Connecticut	3.23	5.69	18.38	0.1
New Jersey	4.91	20.17	99.03	0.3
Pennsylvania	29.01	8.57	248.62	0.7
Michigan	37.18	9.54	354.70	1.0
Wisconsin	36.07	12.44	448.71	1.2
Illinois	35.09	25.36	889.88	2.5
Indiana	23.36	34.44	804.52	2.2
Ohio	26.42	30.64	809.51	2.3
West Virginia	15.41	4.55	70.12	0.2
Maryland	6.55	17.43	114.17	0.3
Delaware	1.29	11.29	14.56	Tr
Virginia	26.05	22.85	595.24	1.7
Kentucky	26.08	26.11	680.95	1.9
Tennessee	27.07	21.55	583.36	1.6
North Carolina	22.51	21.59	485.99	1.4
South Carolina	19.99	27.18	543.33	1.5
Georgia	37.82	21.83	825.61	2.3
Alabama	33.32	19.64	654.40	1.8
Mississippi	30.63	26.37	807.71	2.2
Louisiana	31.14	7.51	233.86	0.7
Florida	35.82	8.42	301.60	0.8
EMU total	577.02 (30.1)		9,975.24	27.8
U.S. total	1,919.46(100.0)		35,913.04	100.0

[a]CMU data from 1967-74.
[b]Figures in parentheses indicate percentage.
[c]Expressed as a percentage of the total U.S. index.

Table A-2. Mourning dove hunting regulations in the Western Management Unit, 1967-76.

State	Seasons 1967	1968	1969	1970	1971
Washington	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.
Oregon	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.
	21 Oct.-9 Nov.	19 Oct.-7 Nov.			
Idaho	1-17 Sept.	1-22 Sept.	1-21 Sept.	1-20 Sept.	1-19 Sept.
Utah	1-30 Sept.	2-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.
Nevada[a]	1 Sept.-20 Oct.	1 Sept.-20 Oct.	1 Sept.-20 Oct.	1 Sept.-20 Oct.	1 Sept.-20 Oct.
California[a]	1 Sept.-10 Oct.	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.
		30 Nov.-8 Dec.	29 Nov.-14 Dec.	28 Nov.-13 Dec.	27 Nov.-12 Dec.
Arizona	1-24 Sept.	1-24 Sept.	1-28 Sept.	1-20 Sept.	1-12 Sept.
	13 Dec.-7 Jan.	11 Dec.-5 Jan.	21 Dec.-11 Jan.	12 Dec.-10 Jan.	3 Dec.-9 Jan.
Bag/possession limits	12/24	10/20	10/20	10/20	10/20
Shooting hours	One-half hour before sunrise to sunset				

State	Seasons 1972	1973	1974	1975	1976
Washington	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.
Oregon	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.
Idaho	1-17 Sept.	1-16 Sept.	1-15 Sept.	1-14 Sept.	1-19 Sept.
Utah	1-30 Sept.	1-30 Sept.	2-30 Sept.	1-30 Sept.	1-30 Sept.
Nevada[a]	1 Sept.-20 Oct.	1 Sept.-20 Oct.	1 Sept.-20 Oct.	1 Sept.-20 Oct.	1 Sept.-20 Oct.
California[a]	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.	1-30 Sept.
	25 Nov.-10 Dec.	24 Nov.-9 Dec.	23 Nov.-8 Dec.	22 Nov.-7 Dec.	20 Nov.-5 Dec.
Arizona	1-17 Sept.	1-23 Sept.	1-22 Sept.	1-21 Sept.	1-20 Sept.
	14 Dec.-15 Jan.	1-27 Dec.	30 Nov.-27 Dec.	7 Dec.-4 Jan.	11 Dec.-9 Jan.
Bag/possession limits	10/20	10/20	10/20	10/20	10/20
Shooting hours	One-half hour before sunrise to sunset				

[a]Aggregate bag and possession limits of mourning doves and white-winged doves apply in counties having a white-winged dove season.

Table A-3. Mourning dove harvest in the Western Management Unit, 1967-76.[a]

State	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	Average
Washington	288,700	420,300	339,200	300,300	318,100	280,000	316,700	263,400	274,600	212,000	301,330
Oregon	172,400	186,400	198,500	208,600	180,800	192,300	156,900	161,100	201,900	179,800	183,870
Idaho	214,400	195,600	220,200	223,900	249,300	251,500	229,800	238,300	246,800	210,100	227,990
Utah	263,900	207,900	279,300	232,500	226,600	238,400	307,100	306,100	420,300	298,500	278,060
Nevada	155,600	110,300	170,400	131,300	115,800	119,500	130,000	140,600	147,200	146,600	136,730
California	5,128,300	4,461,900	4,680,300	4,712,200	4,248,300	3,850,500	4,350,200	4,551,100	4,151,600	3,306,100	4,344,050
Arizona[b,c]	1,412,500	1,709,400	1,727,400	1,424,700	1,552,000	1,671,800	2,345,800	1,984,900	2,122,100	2,148,500	1,809,910
Total	7,635,800	7,291,800	7,615,300	7,233,500	6,890,900	6,604,000	7,836,500	7,645,500	7,564,500	6,501,600	7,281,940

[a]Estimated by individual States from statewide surveys of a percentage of hunting license holders.
[b]Arizona totals for 1967-70 exclude late season estimates.
[c]Arizona totals exclude junior harvest.

Table A-4. Mourning dove harvest regions of the Southern Zone.[a]

Region	Name	Description
1	Northwest Coast	Baja California[b], Sonora, Sinaloa, and Nayarit
2	Northern Highlands	Chihuahua, Durango, Zacatecas, and Aguascalientes
3	Northeast Coast	Coahuila, Nuevo Leon, Tamaulipas, and San Luis Potosi
4	Western Highlands	Jalisco, Guanajuato, Colima, Michoacan, and Guerrero
5	Central Highlands	Queretaro, Hidalgo, Mexico, Mexico D.F., Tlaxcala, Morelos, and Puebla
6	Southern Mexico	Veracruz, Oaxaca, and Chiapas
7	Yucatan Peninsula	Tabasco, Campeche, Yucatan, Quintana Roo, and Belize
8	Central America	Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica

[a]Mexican States and Central American countries. Belize is included in the Yucatan Peninsula of Mexico for convenience.
[b]Baja California Norte and Sur combined.

Table A-5. Criteria for selecting Bird Banding Laboratory records used in the analysis of Western Management Unit mourning dove banding and recovery data.

Category	Banding summary record
AOU no.:	316
State:	All 48 conterminous States
Year:	1967-75
Permit:	All
Month:	1 June-31 August
Day:	All, reformatted
Status:	3 (normal wild bird)
Age:	1 (AHY, adult), 2 (HY, immature)
Sex:	4 (male), 5 (female), 6 (unknown)
Flyway:	Central and parts of Mississippi reformatted to the CMU, Atlantic, and Pacific
Latitude:	All in U.S.
Longitude:	All in U.S.
Direction:	All
Schedule or prefix:	All

Category	Recovery record
The recovery record contains all elements in the banding summary record through column 33, as described above. In addition, the following elements contained only in the recovery record were used in selecting records.	
Date recovered:	In hunting season only, defined as: U.S., 1 Sept.-31 Jan.; Southern Zone (Mexico and Central America), 1 Aug.-31 May. All exact dates, plus all inexact dates, identifiable to acceptable months during recovery years 1967-77
How obtained:	00 (found dead), 01 (shot), 56 (obtained in hunting season), and 98 (band or band number only in hunting season). In the Southern Zone, all "How obtained" recoveries were used
Who reported:	All
Why reported:	All
Where recovered:	For WMU bandings, all; for EMU and CMU bandings, only those in WMU and Southern Zone
Band type:	All
Present condition:	All

Table A-6. Band recoveries by "How obtained" codes[a] of mourning doves banded in the Western Management Unit, 1967-75.

Recoveries No.	Recoveries %	How obtained code	Code definition
4,096	97.9	01	Shot
16	0.4	00	Found dead
19	0.5	98	Band or band number only obtained. No further information available
6	0.1	03	Caught due to: injury
1	Tr	14	Caught due to: striking or being struck by motor vehicle
4	0.1	12	Caught by or due to: cat
1	Tr	99	Previously banded bird trapped and released during banding operations in same 10-minute block where originally banded
3	0.1	20	Caught due to: disease
36	0.9	Other	Miscellaneous means of recovery

[a]Described in Volume 1 of the North American Bird Banding Manual (U.S. Fish and Wildlife Service and Canadian Wildlife Service 1984).

Table A-7. Comparison of "Who and why reported" codes for mourning dove recovery data in the Western and Central Management Units, 1967-75.[a]

Reporter	Who reported codes			
	WMU		CMU[b]	
	No.	%	No.	%
Band finder	2,524	60.6	6,256	68.8
Conservation personnel	1,494	35.9	2,444	26.9
Bird bander	93	2.2	128	1.4
Miscellaneous	52	1.2	248	2.7
Mail questionnaire and parts collection surveys	2	Tr	15	0.2
Total	4,165	99.9	9,091	100.0

Impetus	Why reported codes			
	WMU		CMU[b]	
	No.	%	No.	%
Initiation of finder	3,381	81.2	8,437	92.8
Other person's initiation	694	16.7	395	4.3
Unknown	90	2.2	259	2.8
Total	4,165	100.1	9,091	99.9

[a]1967-74 in the CMU.
[b]From Dunks et al. (1982).

Table A-8. Direct recoveries inside and outside State of banding by 10-day banding periods for immature mourning doves banded in the Western Management Unit, 1967-75.

State banded	June			July			August			Total
	01-10	11-20	21-30	01-10	11-20	21-31	01-10	11-20	21-31	
Washington										
Inside	0	0	0	3	48	59	89	93	11	303
Outside	0	0	0	0	11	20	22	15	3	71
% inside	0	0	0	100	81	75	80	86	79	81
Oregon										
Inside	0	0	0	0	4	4	10	38	72	128
Outside	0	0	0	0	1	0	6	13	16	36
% inside	0	0	0	0	80	100	63	75	82	78
Idaho										
Inside	1	0	0	1	0	1	0	2	0	5
Outside	0	0	1	1	2	2	0	3	0	9
% inside	100	0	0	50	0	33	0	40	0	36
Utah										
Inside	0	0	0	1	2	0	4	9	11	27
Outside	1	0	2	4	4	2	14	13	2	42
% inside	0	0	0	20	33	0	22	41	85	39
Nevada										
Inside	0	0	1	1	2	0	1	14	13	32
Outside	0	0	0	1	8	8	6	11	2	36
% inside	0	0	100	50	20	0	14	56	87	47
California										
Inside	2	0	0	8	30	76	172	281	199	768
Outside	0	0	0	1	3	21	32	23	9	89
% inside	100	0	0	89	91	78	84	92	96	90
Arizona										
Inside	11	13	25	35	41	28	41	85	198	477
Outside	0	5	2	3	4	3	1	6	6	30
% inside	100	72	93	92	91	90	98	93	97	94

Table A-9. Direct recoveries inside and outside State of banding by 10-day banding periods for adult mourning doves banded in the Western Management Unit, 1967-75.

State banded	June			July			August			Total
	01-10	11-20	21-30	01-10	11-20	21-31	01-10	11-20	21-31	
Washington										
Inside	0	0	0	0	11	9	16	10	1	47
Outside	0	0	0	0	3	1	2	2	1	9
% inside	0	0	0	0	79	90	89	83	50	84
Oregon										
Inside	2	1	1	2	3	7	1	9	4	30
Outside	4	0	1	4	1	0	1	2	3	16
% inside	33	100	50	33	75	100	50	82	57	65
Idaho										
Inside	0	0	1	1	0	1	0	0	2	5
Outside	1	0	2	2	1	0	1	1	0	8
% inside	0	0	33	33	0	100	0	0	100	38
Utah										
Inside	0	3	2	12	8	3	14	7	4	53
Outside	0	3	5	4	5	7	3	2	0	29
% inside	0	50	29	75	62	30	82	78	100	65
Nevada										
Inside	4	0	1	1	5	6	4	6	3	30
Outside	2	3	3	2	3	0	0	2	0	15
% inside	67	0	25	33	63	100	100	75	100	67
California										
Inside	5	0	0	2	9	27	53	73	53	222
Outside	0	0	0	0	2	3	6	4	0	15
% inside	100	0	0	100	82	90	90	95	100	94
Arizona										
Inside	12	14	26	26	34	30	38	62	71	313
Outside	1	0	0	3	3	0	0	2	5	14
% inside	92	100	100	90	92	100	100	97	93	96

Table A-10. Direct recoveries, number and (percent), by period of banding for mourning doves banded in the Western Management Unit, 1967-75.

Banding period	Recoveries		
	Immatures	Adults	Total
June			
1-10	15 (0.7)	31 (3.8)	46 (1.6)
11-20	18 (0.9)	24 (3.0)	42 (1.5)
21-30	31 (1.5)	42 (5.2)	73 (2.6)
Subtotal	64 (3.1)	97 (12.0)	161 (5.6)
July			
1-10	59 (2.9)	59 (7.3)	118 (4.1)
11-20	160 (7.8)	88 (10.9)	248 (8.7)
21-31	224 (10.9)	94 (11.7)	318(11.1)
Subtotal	443 (21.6)	241 (29.9)	684(23.9)
August			
1-10	398 (19.4)	139 (17.2)	537(18.8)
11-20	606 (29.5)	182 (22.6)	788(27.6)
21-31	542 (26.4)	147 (18.2)	689(24.1)
Subtotal	1,546 (75.3)	468 (58.1)	2,014(70.4)
Total	2,053(100.0)	806(100.0)	2,859(99.9)

Table A-11. Number of mourning doves banded preseason in the United States, 1967-75.

State	Immatures	Adults			Total doves
		Males	Females	Total	
Alabama	26,942	6,479	5,054	11,781	38,723
Arizona	12,595	4,809	3,930	8,786	21,381
Arkansas	7,584	2,823	1,567	4,526	12,110
California	22,394	4,702	3,075	8,007	30,401
Colorado	13,721	8,758	6,728	15,532	29,253
Connecticut	141	144	42	225	366
Delaware	137	74	44	118	255
Florida	24,306	2,778	1,875	4,920	29,226
Georgia	19,621	4,590	3,044	7,864	27,485
Idaho	1,580	827	536	1,397	2,977
Illinois	10,125	4,306	2,279	7,643	17,768
Indiana	18,833	4,321	1,963	6,403	25,236
Iowa	10,701	9,126	3,850	13,165	23,866
Kansas	8,967	7,601	5,183	12,922	21,889
Kentucky	5,132	1,249	550	2,134	7,266
Louisiana	26,926	4,677	2,889	7,848	34,774
Maine	0	1	2	10	10
Maryland	9,780	3,159	1,904	5,322	15,102
Massachusetts	18,524	3,262	2,217	5,671	24,195
Michigan	2,724	2,919	1,309	4,464	7,188
Minnesota	17,217	5,595	1,974	8,155	25,372
Mississippi	15,602	3,645	1,992	5,734	21,336
Missouri	13,666	4,522	2,682	7,300	20,966
Montana	10,125	1,723	1,055	2,970	13,095
Nebraska	12,216	9,446	4,473	14,211	26,427
Nevada	3,194	1,892	860	2,771	5,965
New Hampshire	101	18	6	169	270
New Jersey	3,760	2,915	1,750	4,816	8,576
New Mexico	15,887	6,467	3,710	10,358	26,245
New York	8,479	2,101	1,008	3,424	11,903
North Carolina	17,465	4,854	3,093	8,026	25,491
North Dakota	9,707	3,418	1,664	5,475	15,182
Ohio	15,052	8,947	3,283	12,630	27,682
Oklahoma	13,031	1,757	1,226	3,170	16,201
Oregon	2,837	613	423	1,201	4,038
Pennsylvania	9,446	3,673	2,225	6,138	15,584
Rhode Island	1,250	394	184	590	1,840
South Carolina	29,063	6,467	4,346	11,004	40,067
South Dakota	21,160	17,096	9,093	26,765	47,925
Tennessee	19,736	4,012	2,603	6,807	26,543
Texas	23,586	14,753	6,998	23,266	46,852
Utah	6,222	5,215	3,407	8,833	15,055
Vermont	6	10	1	14	20
Virginia	17,252	5,490	4,074	9,752	27,004
Washington	7,096	847	764	1,627	8,723
West Virginia	374	151	111	303	677
Wisconsin	9,174	2,813	1,115	4,122	13,296
Wyoming	4,407	1,703	536	2,524	6,931
Total	547,844	197,142	112,697	320,893	868,737

Table A-12. Preseason mourning dove bandings in the Western Management Unit by State, year, age, and sex, 1967-75.

State	Year	Immatures	Adults			Total doves[b]
			Males	Females	Total[a]	
Washington	1967	1,020	222	173	396	1,416
	1968	1,565	216	165	381	1,946
	1969	1,526	130	140	273	1,799
	1970	364	41	27	68	432
	1971	998	159	162	326	1,324
	1972	1,007	57	76	137	1,144
	1973	207	4	0	5	212
	1974	232	11	11	24	256
	1975	177	7	10	17	194
	Total	7,096	847	764	1,627	8,723
Oregon	1967	217	198	150	389	606
	1968	480	207	109	348	828
	1969	319	10	7	24	343
	1970	252	31	13	80	332
	1971	174	4	4	52	226
	1972	647	77	47	126	773
	1973	431	48	60	111	542
	1974	211	29	17	46	257
	1975	106	9	16	25	131
	Total	2,837	613	423	1,201	4,038
Idaho	1967	12	21	12	34	46
	1968	319	19	25	44	363
	1969	233	157	63	222	455
	1970	58	68	36	104	162
	1971	517	149	87	238	755
	1972	89	57	38	96	185
	1973	1	6	1	7	8
	1974	102	31	27	59	161
	1975	249	319	247	593	842
	Total	1,580	827	536	1,397	2,977
Utah	1967	829	545	358	904	1,733
	1968	273	192	174	367	640
	1969	832	647	497	1,149	1,981
	1970	622	518	332	863	1,485
	1971	638	600	437	1,046	1,684
	1972	524	510	328	846	1,370
	1973	385	180	87	270	655
	1974	1,107	1,000	752	1,762	2,869
	1975	1,012	1,023	442	1,626	2,638
	Total	6,222	5,215	3,407	8,833	15,055

Table A-12. Continued.

State	Year	Immatures	Adults			Total doves[b]
			Males	Females	Total[a]	
Nevada	1967	8	96	83	180	188
	1968	57	169	88	257	314
	1969	140	107	80	188	328
	1970	1,273	432	304	736	2,009
	1971	841	608	143	760	1,601
	1972	875	480	162	650	1,525
	Total[c]	3,194	1,892	860	2,771	5,965
California	1967	771	239	146	396	1,167
	1968	1,679	458	378	856	2,535
	1969	1,385	299	171	476	1,861
	1970	1,647	270	155	444	2,091
	1971	1,651	311	236	565	2,216
	1972	4,659	1,286	754	2,148	6,807
	1973	3,557	511	363	875	4,432
	1974	3,740	591	428	1,042	4,782
	1975	3,304	737	444	1,205	4,509
	Total	22,393	4,702	3,075	8,007	30,400
Arizona	1967	1,466	685	821	1,509	2,975
	1968	2,575	1,007	996	2,015	4,590
	1969	1,464	556	433	994	2,458
	1970	1,748	582	237	832	2,580
	1971	1,567	357	117	475	2,042
	1972	1,394	459	592	1,052	2,446
	1973	663	269	154	423	1,086
	1974	1,383	281	224	514	1,897
	1975	335	613	356	972	1,307
	Total	12,595	4,809	3,930	8,786	21,381
Western Management Unit	1967	4,323	2,006	1,743	3,808	8,131
	1968	6,948	2,268	1,935	4,268	11,216
	1969	5,899	1,906	1,391	3,326	9,225
	1970	5,964	1,942	1,104	3,127	9,091
	1971	6,386	2,188	1,186	3,462	9,848
	1972	9,195	2,926	1,997	5,055	14,250
	1973	5,244	1,018	665	1,691	6,935
	1974	6,775	1,943	1,459	3,447	10,222
	1975	5,183	2,708	1,515	4,438	9,621
	Total	55,917	18,905	12,995	32,622	88,539

[a]Includes unknown sex adults.
[b]Excludes one dove of unknown age and sex (California).
[c]No doves banded in Nevada during 1973-75.

Table A-13. Sex and age of mourning doves banded in the Western Management Unit, 1967-75.

State	Number banded		Sex ratio
	Males	Females	
Washington	847	764	118:100
Oregon	613	423	145:100
Idaho	827	536	154:100
Utah	5,215	3,407	153:100
Nevada	1,892	860	220:100
California	4,702	3,075	153:100
Arizona	4,809	3,930	122:100
Total	18,905	12,995	145:100

State	Number banded		Age ratio
	Immatures	Adults	
Washington	7,096	1,627	436:100
Oregon	2,837	1,201	236:100
Idaho	1,580	1,397	113:100
Utah	6,222	8,833	70:100
Nevada	3,194	2,771	115:100
California	22,393	8,007	280:100
Arizona	12,595	8,786	143:100
Total	55,917	32,622	171:100

Table A-14. Distribution of direct recoveries of immature mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	303 (81.0)		1 (7.1)					304 (14.8)
Oregon		128 (78.0)						128 (6.2)
Idaho	1 (0.3)		5(35.7)					6 (0.3)
Utah	2 (0.5)			27 (39.1)				29 (1.4)
Nevada	3 (0.8)	1 (0.6)			32 (47.1)			36 (1.8)
California	32 (8.6)	22 (13.4)	3(21.4)	10 (14.5)	12 (17.6)	768(89.6)	3 (0.6)	850 (41.4)
Arizona	4 (1.1)	2 (1.2)	1 (7.1)	14 (20.3)	15 (22.1)	25 (2.9)	477 (94.1)	538 (26.2)
Subtotal	345 (92.2)	153 (93.3)	10(71.4)	51 (73.9)	59 (86.8)	793(92.5)	480 (94.7)	1,891 (92.1)
CMU								
Colorado	1 (0.3)					1 (0.1)		2 (0.1)
New Mexico				2 (2.9)			1 (0.2)	3 (0.1)
Texas	2 (0.5)			2 (2.9)		1 (0.1)	2 (0.4)	7 (0.3)
Subtotal	3 (0.8)	0	0	4 (5.8)	0	2 (0.2)	3 (0.6)	12 (0.6)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Mexico								
NW Coast	2 (0.5)	2 (1.2)	1 (7.1)	1 (1.4)	1 (1.5)	15 (1.8)	4 (0.8)	26 (1.3)
N. Highlands				1 (1.4)		1 (0.1)		2 (0.1)
NE Coast								0
W. Highlands	23 (6.1)	9 (5.5)	2(14.3)	11 (15.9)	8 (11.8)	46 (5.4)	17 (3.4)	116 (5.7)
C. Highlands	1 (0.3)						1 (0.2)	2 (0.1)
Southern Yucatan Penin.								0
Unknown								0
Subtotal	26 (7.0)	11 (6.7)	3(21.4)	1 (1.4) 14 (20.3)	9 (13.2)	62 (7.2)	2 (0.4) 24 (4.7)	3 (0.1) 149 (7.3)
Central America								
Subtotal	0	0	1 (7.1)	0	0	0	0	1 (Tr)
Total	374(100.0)	164(100.0)	14(99.9)	69(100.0)	68(100.0)	857(99.9)	507(100.0)	2,053(100.0)
Total banded	7,096	2,837	1,580	6,222	3,194	22,394	12,595	55,918
Recovery rate	5.27	5.78	0.89	1.11	2.13	3.83	4.03	3.67

Table A-15. Distribution of direct recoveries of adult male mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	25 (80.6)							25 (5.0)
Oregon		17 (70.8)						17 (3.4)
Idaho			3 (42.9)					3 (0.6)
Utah				35 (66.0)				35 (7.0)
Nevada					24 (75.0)			24 (4.8)
California	6 (19.4)	4 (16.7)	1 (14.3)		1 (3.1)	121 (93.1)	7 (3.1)	140 (28.0)
Arizona		1 (4.2)	2 (28.6)	12 (22.6)	6 (18.8)	2 (1.5)	215 (96.4)	238 (47.6)
Subtotal	31(100.0)	22 (91.7)	6 (85.7)	47 (88.7)	31 (96.9)	123 (94.6)	222 (99.6)	482 (96.4)
CMU								
Texas					1 (3.1)			1 (0.2)
Subtotal	0	0	0	0	1 (3.1)	0	0	1 (0.2)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Mexico								
NW Coast				3 (5.7)		4 (3.1)	1 (0.4)	8 (1.6)
N. Highlands		1 (4.2)	1 (14.3)					2 (0.4)
NE Coast								0
W. Highlands		1 (4.2)		2 (3.8)		3 (2.3)		6 (1.2)
C. Highlands								0
Southern								0
Yucatan Penin.								0
Unknown								0
Subtotal	0	2 (8.3)	1 (14.3)	5 (9.4)	0	7 (5.4)	1 (0.4)	16 (3.2)
Central America								
Subtotal	0	0	0	1 (1.9)	0	0	0	1 (0.2)
Total	31(100.0)	24(100.0)	7(100.0)	53(100.0)	32(100.0)	130(100.0)	223(100.0)	500(100.0)
Total banded	847	613	827	5,215	1,892	4,702	4,809	18,905
Recovery rate	3.66	3.92	0.85	1.02	1.69	2.76	4.64	2.64

Table A-16. Distribution of direct recoveries of adult female mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	22 (88.0)	1 (7.1)	1 (16.7)					24 (8.5)
Oregon		8(57.1)						8 (2.8)
Idaho			2 (33.3)					2 (0.7)
Utah				16 (61.5)				16 (5.7)
Nevada	1 (4.0)				6 (46.2)		1 (1.0)	8 (2.8)
California	2 (8.0)	5(35.7)	1 (16.7)		4 (30.8)	91 (94.8)	2 (2.0)	105 (37.2)
Arizona			1 (16.7)	7 (26.9)	2 (15.4)	5 (5.2)	96 (94.1)	111 (39.4)
Subtotal	25(100.0)	14(99.9)	5 (83.3)	23 (88.5)	12 (92.3)	96(100.0)	99 (97.1)	274 (97.2)
CMU								
Subtotal	0	0	0	0	0	0	0	0
EMU								
Subtotal	0	0	0	0	0	0	0	0
Mexico								
NW Coast					1 (7.7)		1 (1.0)	2 (0.7)
N. Highlands							1 (1.0)	1 (0.4)
NE Coast				1 (3.8)				1 (0.4)
W. Highlands			1 (16.7)	2 (7.7)			1 (1.0)	4 (1.4)
C. Highlands								0
Southern								0
Yucatan Penin.								0
Unknown								0
Subtotal	0	0	1 (16.7)	3 (11.5)	1 (7.7)	0	3 (2.9)	8 (2.8)
Central America								
Subtotal	0	0	0	0	0	0	0	0
Total	25(100.0)	14(99.9)	6(100.0)	26(100.0)	13(100.0)	96(100.0)	102(100.0)	282(100.0)
Total banded	764	423	536	3,407	860	3,075	3,930	12,995
Recovery rate	3.27	3.31	1.12	0.76	1.51	3.12	2.60	2.17

Table A-17. Distribution of direct recoveries of adult mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	47 (83.9)	1 (2.2)	1 (7.7)					49 (6.1)
Oregon		30 (65.2)						30 (3.7)
Idaho			5 (38.5)					5 (0.6)
Utah				53 (64.6)				53 (6.6)
Nevada	1 (1.8)				30 (66.7)		1 (0.3)	32 (4.0)
California	8 (14.3)	10 (21.7)	2 (15.4)		5 (11.1)	222 (93.7)	9 (2.8)	256(31.8)
Arizona		2 (4.3)	3 (23.1)	19 (23.2)	8 (17.8)	7 (3.0)	313 (95.7)	352(43.7)
Subtotal	56(100.0)	43 (93.5)	11 (84.6)	72 (87.8)	43 (95.6)	229 (96.6)	323 (98.8)	777(96.4)
CMU								
Texas					1 (2.2)			1 (0.1)
Subtotal	0	0	0	0	1 (2.2)	0	0	1 (0.1)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Mexico								
NW Coast		1 (2.2)		4 (4.9)	1 (2.2)	5 (2.1)	2 (0.6)	13 (1.6)
N. Highlands		1 (2.2)	1 (7.7)				1 (0.3)	3 (0.4)
NE Coast				1 (1.2)				1 (0.1)
W. Highlands		1 (2.2)	1 (7.7)	4 (4.9)		3 (1.3)	1 (0.3)	10 (1.2)
C. Highlands								0
Southern								0
Yucatan Penin.								0
Unknown								0
Subtotal	0	3 (6.5)	2 (15.4)	9 (11.0)	1 (2.2)	8 (3.4)	4 (1.2)	27 (3.3)
Central America								
Subtotal	0	0	0	1 (1.2)	0	0	0	1 (0.1)
Total	56(100.0)	46(100.0)	13(100.0)	82(100.0)	45(100.0)	237(100.0)	327(100.0)	806(99.9)
Total banded	1,627	1,201	1,397	8,833	2,771	8,007	8,786	32,622
Recovery rate	3.44	3.83	0.93	0.93	1.62	2.96	3.72	2.47

Table A-18. Distribution of direct recoveries of all mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	350 (81.4)	1 (0.5)	2 (7.4)					353 (12.3)
Oregon		158 (75.2)						158 (5.5)
Idaho	1 (0.2)		10 (37.0)					11 (0.4)
Utah	2 (0.5)			80 (53.0)				82 (2.9)
Nevada	4 (0.9)	1 (0.5)			62 (54.9)		1 (0.1)	68 (2.4)
California	40 (9.3)	32 (15.2)	5 (18.5)	10 (6.6)	17 (15.0)	990 (90.5)	12 (1.4)	1,106 (38.7)
Arizona	4 (0.9)	4 (1.9)	4 (14.8)	33 (21.9)	23 (20.4)	32 (2.9)	790 (94.7)	890 (31.1)
Subtotal	401 (93.3)	196 (93.3)	21 (77.8)	123 (81.5)	102 (90.3)	1,022 (93.4)	803 (96.3)	2,668 (93.3)
CMU								
Colorado	1 (0.2)					1 (0.1)		2 (0.1)
New Mexico				2 (1.3)			1 (0.1)	3 (0.1)
Texas	2 (0.5)			2 (1.3)	1 (0.9)	1 (0.1)	2 (0.2)	8 (0.3)
Subtotal	3 (0.7)	0	0	4 (2.6)	1 (0.9)	2 (0.2)	3 (0.4)	13 (0.5)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Mexico								
NW Coast	2 (0.5)	3 (1.4)	1 (3.7)	5 (3.3)	2 (1.8)	20 (1.8)	6 (0.7)	39 (1.4)
N. Highlands		1 (0.5)	1 (3.7)	1 (0.7)		1 (0.1)	1 (0.1)	5 (0.2)
NE Coast				1 (0.7)				1 (Tr)
W. Highlands	23 (5.3)	10 (4.8)	3 (11.1)	15 (9.9)	8 (7.1)	49 (4.5)	18 (2.2)	126 (4.4)
C. Highlands	1 (0.2)						1 (0.1)	2 (0.1)
Southern Yucatan Penin.								0
Unknown				1 (0.7)			2 (0.2)	3 (0.1)
Subtotal	26 (6.0)	14 (6.7)	5 (18.5)	23 (15.2)	10 (8.8)	70 (6.4)	28 (3.4)	176 (6.2)
Central America								
Subtotal	0	0	1 (3.7)	1 (0.7)	0	0	0	2 (0.1)
Total	430(100.0)	210(100.0)	27(100.0)	151(100.0)	113(100.0)	1,094(100.0)	834(100.1)	2,859(100.1)
Total banded	8,723	4,038	2,977	15,055	5,965	30,401	21,381	88,540
Recovery rate	4.93	5.20	0.91	1.00	1.89	3.60	3.90	3.23

Table A-19. Distribution of indirect recoveries of immature mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	107 (75.9)				1 (2.1)			108 (13.6)
Oregon	4 (2.8)	18 (54.5)		1 (2.9)		3 (1.0)		26 (3.3)
Idaho	1 (0.7)		10(71.4)					11 (1.4)
Utah			1 (7.1)	9 (25.7)	1 (2.1)	1 (0.3)	1 (0.5)	13 (1.6)
Nevada	1 (0.7)				13 (27.1)	2 (0.7)	1 (0.5)	17 (2.1)
California	14 (9.9)	10 (30.3)	1 (7.1)	3 (8.6)	14 (29.2)	244 (80.5)	19 (8.6)	305 (38.3)
Arizona	2 (1.4)	2 (6.1)		12 (34.3)	12 (25.0)	20 (6.6)	185 (83.3)	233 (29.3)
Subtotal	129 (91.5)	30 (90.9)	12(85.7)	25 (71.4)	41 (85.4)	270 (89.1)	206 (92.8)	713 (89.6)
CMU								
Colorado							1 (0.5)	1 (0.1)
New Mexico			1 (7.1)				2 (0.9)	3 (0.4)
Texas	3 (2.1)							3 (0.4)
Subtotal	3 (2.1)	0	1 (7.1)	0	0	0	3 (1.4)	7 (0.9)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Mexico								
NW Coast	3 (2.1)			5 (14.3)	3 (6.3)	9 (3.0)	2 (0.9)	22 (2.8)
N. Highlands	1 (0.7)					2 (0.7)	3 (1.4)	6 (0.8)
NE Coast								0
W. Highlands	4 (2.8)	3 (9.1)	1 (7.1)	4 (11.4)	2 (4.2)	18 (5.9)	8 (3.6)	40 (5.0)
C. Highlands				1 (2.9)		2 (0.7)		3 (0.4)
Southern Yucatan Penin.								0
Unknown	1 (0.7)				2 (4.2)	1 (0.3)		4 (0.5)
Subtotal	9 (6.4)	3 (9.1)	1 (7.1)	10 (28.6)	7 (14.6)	32 (10.6)	13 (5.9)	75 (9.4)
Central America								
Subtotal	0	0	0	0	0	1 (0.3)	0	1 (0.1)
Total	141(100.0)	33(100.0)	14(99.9)	35(100.0)	48(100.0)	303(100.0)	222(100.1)	796(100.0)
Total banded	7,096	2,837	1,580	6,222	3,194	22,394	12,595	55,918
Recovery rate	1.99	1.16	0.89	0.56	1.50	1.35	1.76	1.42

Table A-20. Distribution of indirect recoveries of adult male mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	18 (75.0)	2 (22.2)						20 (5.9)
Oregon	1 (4.2)	6 (66.7)						7 (2.1)
Idaho	1 (4.2)		4 (50.0)	4 (9.5)				9 (2.6)
Utah				21 (50.0)	1 (2.5)		1 (0.9)	23 (6.8)
Nevada					22 (55.0)	2 (1.8)		24 (7.1)
California	3 (12.5)			1 (2.4)	6 (15.0)	95 (85.6)	5 (4.7)	110 (32.4)
Arizona	1 (4.2)	1 (11.1)		6 (14.3)	5 (12.5)	5 (4.5)	99 (93.4)	117 (34.4)
Subtotal	24(100.1)	9(100.0)	4 (50.0)	32 (76.2)	34 (85.0)	102 (91.9)	105 (99.1)	310 (91.2)
CMU								
Colorado				1 (2.4)				1 (0.3)
Texas					2 (5.0)			2 (0.6)
Subtotal	0	0	0	1 (2.4)	2 (5.0)	0	0	3 (0.9)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Mexico								
NW Coast			1 (12.5)	4 (9.5)	2 (5.0)	3 (2.7)	1 (0.9)	11 (3.2)
N. Highlands			2 (25.0)	1 (2.4)				3 (0.9)
NE Coast					1 (2.5)			1 (0.3)
W. Highlands			1 (12.5)	4 (9.5)		6 (5.4)		11 (3.2)
C. Highlands								0
Southern								0
Yucatan Penin.								0
Unknown					1 (2.5)			1 (0.3)
Subtotal	0	0	4 (50.0)	9 (21.4)	4 (10.0)	9 (8.1)	1 (0.9)	27 (7.9)
Central America								
Subtotal	0	0	0	0	0	0	0	0
Total	24(100.1)	9(100.0)	8(100.0)	42(100.0)	40(100.0)	111(100.0)	106(100.0)	340(100.0)
Total banded	847	613	827	5,215	1,892	4,702	4,809	18,905
Recovery rate	2.83	1.47	0.97	0.81	2.11	2.36	2.20	1.80

Table A-21. Distribution of indirect recoveries of adult female mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	12 (63.2)							12 (7.4)
Oregon	1 (5.3)	3 (50.0)				1 (1.9)	1 (1.7)	6 (3.7)
Idaho			2 (66.7)					2 (1.2)
Utah				6 (42.9)			2 (3.4)	8 (4.9)
Nevada	1 (5.3)				6 (66.7)			7 (4.3)
California	2 (10.5)	2 (33.3)		2 (14.3)	1 (11.1)	41 (78.8)	3 (5.1)	51 (31.5)
Arizona	1 (5.3)	1 (16.7)		3 (21.4)		1 (1.9)	52 (88.1)	58 (35.8)
Subtotal	17 (89.5)	6(100.0)	2 (66.7)	11 (78.6)	7 (77.8)	43 (82.7)	58 (98.3)	144 (88.9)
CMU								
New Mexico						1 (1.9)		1 (0.6)
Subtotal	0	0	0	0	0	1 (1.9)	0	1 (0.6)
EMU								
Subtotal	1 (5.3)	0	0	0	0	0	0	1 (0.6)
Mexico								
NW Coast	1 (5.3)		1 (33.3)	3 (21.4)		3 (5.8)	1 (1.7)	9 (5.6)
N. Highlands					1 (11.1)	2 (3.8)		3 (1.9)
NE Coast								0
W. Highlands					1 (11.1)	2 (3.8)		3 (1.9)
C. Highlands								0
Southern Yucatan Penin.								0
Unknown						1 (1.9)		1 (0.6)
Subtotal	1 (5.3)	0	1 (33.3)	3 (21.4)	2 (22.2)	8 (15.4)	1 (1.7)	16 (9.9)
Central America								
Subtotal	0	0	0	0	0	0	0	0
Total	19(100.1)	6(100.0)	3(100.0)	14(100.0)	9(100.0)	52(100.0)	59(100.0)	162(100.0)
Total banded	764	423	536	3,407	860	3,075	3,930	12,995
Recovery rate	2.49	1.42	0.56	0.41	1.05	1.69	1.50	1.25

Table A-22. Distribution of indirect recoveries of adult mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	30(69.8)	2 (10.5)						32 (6.3)
Oregon	2 (4.7)	11 (57.9)				1 (0.6)	1 (0.6)	15 (2.9)
Idaho	1 (2.3)		6 (54.5)	4 (7.1)				11 (2.2)
Utah				27 (48.2)	1 (2.0)		3 (1.8)	31 (6.1)
Nevada	1 (2.3)				28 (57.1)	2 (1.2)		31 (6.1)
California	5(11.6)	4 (21.1)		3 (5.4)	7 (14.3)	138 (83.1)	8 (4.8)	165 (32.4)
Arizona	2 (4.7)	2 (10.5)		9 (16.1)	5 (10.2)	6 (3.6)	152 (91.6)	176 (34.5)
Subtotal	41(95.3)	19(100.0)	6 (54.5)	43 (76.8)	41 (83.7)	147 (88.6)	164 (98.8)	461 (90.4)
CMU								
Colorado				1 (1.8)				1 (0.2)
New Mexico						1 (0.6)		1 (0.2)
Texas					2 (4.1)			2 (0.4)
Subtotal	0	0	0	1 (1.8)	2 (4.1)	1 (0.6)	0	4 (0.8)
EMU								
Subtotal	1 (2.3)	0	0	0	0	0	0	1 (0.2)
Mexico								
NW Coast	1 (2.3)		2 (18.2)	7 (12.5)	2 (4.1)	7 (4.2)	2 (1.2)	21 (4.1)
N. Highlands			2 (18.2)	1 (1.8)	1 (2.0)	2 (1.2)		6 (1.2)
NE Coast					1 (2.0)			1 (0.2)
W. Highlands			1 (9.1)	4 (7.1)	1 (2.0)	8 (4.8)		14 (2.7)
C. Highlands								0
Southern								0
Yucatan Penin.								0
Unknown					1 (2.0)	1 (0.6)		2 (0.4)
Subtotal	1 (2.3)	0	5 (45.5)	12 (21.4)	6 (12.2)	18 (10.8)	2 (1.2)	44 (8.6)
Central America								
Subtotal	0	0	0	0	0	0	0	0
Total	43(99.9)	19(100.0)	11(100.0)	56(100.0)	49(100.0)	166(100.0)	166(100.0)	510(100.0)
Total banded	1,627	1,201	1,397	8,833	2,771	8,007	8,786	32,622
Recovery rate	2.64	1.58	0.79	0.63	1.77	2.07	1.89	1.56

Table A-23. Distribution of indirect recoveries of all mourning doves banded preseason in the Western Management Unit, 1967-75; number and (percent).

Recovery area	Banding area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
WMU								
Washington	137(74.5)	2 (3.8)			1 (1.0)			140 (10.7)
Oregon	6 (3.3)	29 (55.8)		1 (1.1)		4 (0.9)	1 (0.3)	41 (3.1)
Idaho	2 (1.1)		16 (64.0)	4 (4.4)				22 (1.7)
Utah			1 (4.0)	36 (39.6)	2 (2.1)	1 (0.2)	4 (1.0)	44 (3.4)
Nevada	2 (1.1)				41 (42.3)	4 (0.9)	1 (0.3)	48 (3.7)
California	19(10.3)	14 (26.9)	1 (4.0)	6 (6.6)	21 (21.6)	382 (81.4)	27 (7.0)	470 (36.0)
Arizona	4 (2.2)	4 (7.7)		21 (23.1)	17 (17.5)	26 (5.5)	337 (86.9)	409 (31.3)
Subtotal	170(92.4)	49 (94.2)	18 (72.0)	68 (74.7)	82 (84.5)	417 (88.9)	370 (95.4)	1,174 (89.9)
CMU								
Colorado				1 (1.1)			1 (0.3)	2 (0.2)
New Mexico			1 (4.0)			1 (0.2)	2 (0.5)	4 (0.3)
Texas	3 (1.6)				2 (2.1)			5 (0.4)
Subtotal	3 (1.6)	0	1 (4.0)	1 (1.1)	2 (2.1)	1 (0.2)	3 (0.8)	11 (0.8)
EMU								
Subtotal	1 (0.5)	0	0	0	0	0	0	1 (0.1)
Mexico								
NW Coast	4 (2.2)		2 (8.0)	12 (13.2)	5 (5.2)	16 (3.4)	4 (1.0)	43 (3.3)
N. Highlands	1 (0.5)		2 (8.0)	1 (1.1)	1 (1.0)	4 (0.9)	3 (0.8)	12 (0.9)
NE Coast					1 (1.0)			1 (0.1)
W. Highlands	4 (2.2)	3 (5.8)	2 (8.0)	8 (8.8)	3 (3.1)	26 (5.5)	8 (2.1)	54 (4.1)
C. Highlands				1 (1.1)		2 (0.4)		3 (0.2)
Southern Yucatan Penin.								0 0
Unknown	1 (0.5)				3 (3.1)	2 (0.4)		6 (0.5)
Subtotal	10 (5.4)	3 (5.8)	6 (24.0)	22 (24.2)	13 (13.4)	50 (10.7)	15 (3.9)	119 (9.1)
Central America								
Subtotal	0	0	0	0	0	1 (0.2)	0	1 (0.1)
Total	184(99.9)	52(100.0)	25(100.0)	91(100.0)	97(100.0)	469(100.0)	388(100.1)	1,306(100.0)
Total banded	8,723	4,038	2,977	15,055	5,965	30,401	21,381	88,540
Recovery rate	2.11	1.29	0.84	0.60	1.63	1.54	1.81	1.48

Table A-24. Distribution of direct recovery rate indices[a] for immature mourning doves banded preseason in the Western Management Unit, 1967-75.

Recovery area	Banding area						
	Wash.	Oreg.	Idaho	Utah	Nev.	Calif.	Ariz.
WMU							
Washington	427		6				
Oregon		451					
Idaho	1		32				
Utah	3			43			
Nevada	4	4			100		
California	45	78	19	16	38	343	2
Arizona	6	7	6	23	47	11	379
Subtotal	486	539	63	82	185	354	381
CMU							
Subtotal	4	0	0	6	0	1	2
EMU							
Subtotal	0	0	0	0	0	0	0
U.S. total	490	539	63	88	185	355	383
Southern Zone							
Mexico	37	39	19	23	28	28	19
Central America	0	0	6	0	0	0	0
Southern Zone total	37	39	25	23	28	28	19
Total	527	578	89	111	213	383	403
Number banded	7,096	2,837	1,580	6,222	3,194	22,394	12,595
Number of recoveries	374	164	14	69	68	857	507

[a]Recovery rate index = recovery rate x 10,000; these indices reflect the relative frequencies at which individual doves will be taken in given recovery locations. Example: An immature dove from Oregon is about four times more likely to be recovered in California than an immature from Idaho.

Table A-25. Distribution of direct recovery rate indices[a] for adult mourning doves banded preseason in the Western Management Unit, 1967-75.

Recovery area	Banding area						
	Wash.	Oreg.	Idaho	Utah	Nev.	Calif.	Ariz.
WMU							
Washington	289	8	7				
Oregon		250					
Idaho			36				
Utah				60			
Nevada	6				108		1
California	49	83	14		18	277	10
Arizona		17	21	22	29	9	356
Subtotal	344	358	79	82	155	286	368
CMU							
Subtotal	0	0	0	0	4	0	0
EMU							
Subtotal	0	0	0	0	0	0	0
U.S. total	344	358	79	82	159	286	368
Southern Zone							
Mexico		25	14	10	4	10	5
Central America				1			
Southern Zone total	0	25	14	11	4	10	5
Total	344	383	93	93	162	296	372
Number banded	1,627	1,201	1,397	8,833	2,771	8,007	8,786
Number of recoveries	56	46	13	82	45	237	327

[a]Recovery rate index = recovery rate x 10,000; these indices reflect the relative frequencies at which individual doves will be taken in given recovery locations. Example: An adult dove from Oregon is 2.5 times more likely to be recovered in Mexico than an adult from Utah or California.

Table A-26. Distribution of direct recovery rate indices[a] for all mourning doves banded preseason in the Western Management Unit, 1967-75.

Recovery area	Banding area						
	Wash.	Oreg.	Idaho	Utah	Nev.	Calif.	Ariz.
WMU							
Washington	401	2	7				
Oregon		391					
Idaho	1		34				
Utah	2			53			
Nevada	5	2			104		<1
California	46	79	17	7	28	326	7
Arizona	5	10	13	22	39	11	369
Subtotal	460	485	71	82	171	336	376
CMU							
Subtotal	3	0	0	3	2	1	1
EMU							
Subtotal	0	0	0	0	0	0	0
U.S. total	463	485	71	84	173	337	377
Southern Zone							
Mexico	30	35	17	15	17	23	13
Central America	0	0	3	1	0	0	0
Southern Zone total	30	35	20	16	17	23	13
Total	493	520	91	100	189	360	390
Number banded	8,723	4,038	2,977	15,055	5,965	30,401	21,381
Number of recoveries	430	210	27	151	113	1,094	834

[a]Recovery rate index = recovery rate x 10,000; these indices reflect the relative frequencies at which individual doves will be taken in given recovery locations. Example: Individual doves from Washington or Oregon are twice as likely to be recovered in Mexico than individual doves from Idaho, Utah, or Nevada.

Table A-27. Direct recovery rate indices (RRI) for mourning doves banded in the Western and Central Management Units, 1967-75.

Recovery location	RRI for doves banded in: WMU	CMU
Unit of banding	301.33	124.40
Adjacent unit (CMU/WMU)	1.47	1.44
EMU	--	8.79
Mexico	19.88	20.91
Central America	0.23	2.92
Total	322.91	158.46

Table A-28. Mourning dove direct recovery rate indices (RRI) in the Southern Zone for selected groups of States, 1967-75. All ages and sexes combined.

Group I States	Bandings	Recoveries in Southern Zone	RRI
Washington	8,723	26	30
Oregon	4,038	14	35
Montana	13,095	43	33
North Dakota	15,182	45	30
Minnesota	25,372	79	31
South Dakota	47,925	137	29
Wyoming	6,931	18	26
Nebraska	26,427	86	33
Colorado	29,253	76	26
Oklahoma	16,201	51	31
Total	193,147	575	30

Group II States	Bandings	Recoveries in Southern Zone	RRI
Idaho	2,977	6	20
Utah	15,055	24	16
Nevada	5,965	10	17
California	30,401	70	23
Iowa	23,866	41	17
Kansas	21,889	53	24
New Mexico	26,245	55	21
North Texas	33,879	70	21
Total	160,277	329	21

Group III States	Bandings	Recoveries in Southern Zone	RRI
Arizona	21,381	28	13
Missouri	20,966	20	10
Arkansas	12,110	6	5
South Texas	12,973	12	9
Total	67,430	66	10

Table A-29. Chi-square tests of hypothesis that similar proportions of direct recoveries of adult and immature mourning doves occur in State of banding.

State	Adult			Immature			χ^{2a}
	Total	In-State	%	Total	In-State	%	
Washington	56	47	83.9	374	303	81.0	0.27
Oregon	46	30	65.2	164	128	78.0	3.18*
Idaho	13	5	38.5	14	5	35.7	0.23
Utah	82	53	64.6	69	27	39.1	9.79***
Nevada	45	30	66.7	68	32	47.1	4.20**
California	237	222	93.7	857	768	89.6	3.55*
Arizona	327	313	95.7	507	477	94.1	1.06
Total	806	700	86.8	2,053	1,740	84.8	2.03

[a]χ^2 statistics with 1 df; $P < 0.10$*; $P < 0.05$**; $P < 0.01$***.

Table A-30. Relative recovery rates for mourning doves banded in the Western and Central Management Units and recovered in selected areas, 1967-77.

Recovery area	Recovery rate index		Relative recovery rate
	Adults	Immatures	
Banded in Western Management Unit			
Western Management Unit	238.2	338.2	1.4
Central Management Unit	0.3	2.1	7.0
Mexico	8.3	26.6	3.2
Central America	0.3	0.2	0.7
Total	247.1	367.1	1.5
Banded in Central Management Unit			
Central Management Unit	120.7	127.4	1.1
Western Management Unit	0.8	2.0	2.5
Eastern Management Unit	3.4	13.2	3.9
Mexico	12.2	28.1	2.3
Central America	2.9	2.9	1.0
Total	140.1	173.7	1.2

Table A-31. Chi-square tests of hypothesis that similar proportions of direct recoveries of adult male and female mourning doves occur in State of banding.

State	Adult males			Adult females			χ^{2a}
	Total	In-State	%	Total	In-State	%	
Washington	31	25	80.6	25	22	88.0	0.56
Oregon	24	17	70.8	14	8	57.1	0.74
Idaho	7	3	42.9	6	2	33.3	0.13
Utah	53	35	66.0	26	16	61.5	0.15
Nevada	32	24	75.0	13	6	46.2	3.47*
California	130	121	93.1	96	91	94.8	0.28
Arizona	223	215	96.4	102	96	94.1	0.90
Total	500	440	88.0	282	241	85.5	1.03

[a]χ^2 statistics with 1 df; $P < 0.10$*; $P < 0.05$**; $P < 0.01$***.

Table A-32. Weighting factors for recoveries of mourning doves banded preseason in the U.S., 1967-75.[a]

Area of banding	A	B	C			A X B / C		
	Land area weight	Mean no. of doves per route	Immature doves banded	Adult doves banded	All doves banded	Weighting factor (x 100) Immatures	Adults	All doves
EMU								
Massachusetts	5.31	6.81	18,524	5,671	24,195	0.20	0.64	0.15
Michigan	37.18	9.54	2,724	4,464	7,188	13.02	7.95	4.93
Wisconsin	36.07	12.44	9,174	4,122	13,296	4.89	10.89	3.37
Illinois	35.09	25.36	10,125	7,643	17,768	8.79	11.64	5.01
Indiana	23.36	34.44	18,833	6,403	25,236	4.27	12.56	3.19
Ohio	26.42	30.64	15,052	12,630	27,682	5.38	6.41	2.92
Virginia	26.05	22.85	17,252	9,752	27,004	3.45	6.10	2.20
Kentucky	26.08	26.11	5,132	2,134	7,266	13.27	31.91	9.37
Tennessee	27.07	21.55	19,736	6,807	26,543	2.96	8.57	2.20
South Carolina	19.99	27.18	29,063	11,004	40,067	1.87	4.94	1.36
Alabama	33.32	19.64	26,942	11,781	38,723	2.43	5.55	1.69
Mississippi	30.63	26.37	15,602	5,734	21,336	5.18	14.09	3.79
Louisiana	31.14	7.51	26,926	7,848	34,774	0.87	2.98	0.67
CMU								
Montana	94.47	10.98	10,125	2,970	13,095	10.24	34.93	7.92
North Dakota	45.54	24.45	9,707	5,475	15,182	11.47	20.34	7.33
Minnesota	54.09	13.71	17,217	8,155	25,372	4.31	9.09	2.92
South Dakota	49.20	37.72	21,160	26,765	47,925	8.77	6.93	3.87
Wyoming	62.33	10.41	4,407	2,524	6,931	14.72	25.71	9.36
Nebraska	49.69	40.27	12,216	14,211	26,427	16.38	14.08	7.57
Iowa	36.15	28.52	10,701	13,165	23,866	9.63	7.83	4.32
Missouri	45.10	31.70	13,666	7,300	20,966	10.46	19.58	6.82
Kansas	52.43	55.22	8,967	12,922	21,889	32.29	22.41	13.23
Colorado	67.18	14.93	13,721	15,532	29,253	7.31	6.46	3.43
New Mexico	77.98	11.35	15,887	10,358	26,245	5.57	8.54	3.37
Oklahoma	44.40	31.29	13,031	3,170	16,201	10.66	43.83	8.58
Arkansas	34.37	23.32	7,584	4,526	12,110	10.57	17.71	6.62
Texas	170.03	19.31	23,586	23,266	46,852	13.92	14.11	7.01
WMU								
Washington	43.87	8.12	7,096	1,627	8,723	5.02	21.89	4.08
Oregon	62.27	8.88	2,837	1,201	4,038	19.49	46.04	13.69
Idaho	54.37	11.81	1,580	1,397	2,977	40.64	45.96	21.57
Utah	53.34	15.69	6,222	8,833	15,055	13.45	9.47	5.56
Nevada	71.27	4.92	3,194	2,771	5,965	10.98	12.65	5.88
California	101.71	13.64	22,394	8,007	30,401	6.20	17.33	4.56
Arizona	72.65	23.34	12,595	8,786	21,381	13.46	19.30	7.93

[a]Mourning doves in the CMU were banded 1967-74.

Table A-33. Distribution and relative density of mourning dove harvest in the Western Management Unit, 1967-75. All ages and sexes combined.

Harvest area	Number of recoveries	Weighted totals[a]	Percent of harvest	Relative harvest density[b]
Washington	353	1,484.83	8.5	33.8
Oregon	158	2,163.02	12.4	34.7
Idaho	13	235.62	1.4	4.3
Utah	84	468.80	2.7	8.8
Nevada	68	402.50	2.3	5.6
California	1,124	5,581.77	32.1	54.9
Arizona	919	7,043.02	40.5	96.9
Total	2,719	17,379.56	99.9	--

[a]Each figure represents total weighted direct recoveries of all birds recovered in each harvest State.
[b]Weighted recoveries divided by land area weight (Table A-32, Col. A).

Table A-34. Weighted distribution (%) of the mourning dove harvest in the Southern Zone by Western Management Unit State of banding. All ages and sexes combined - direct recoveries.

Recovery area	Contributing area (%)							
	Wash.	Oreg.	Idaho	Utah	Nev.	Calif.	Ariz.	WMU total
1 - Northwest Coast								
Baja California[a]		14.3		4.3	20.0	8.6	7.7	7.7
Sonora				4.3		2.9	3.8	2.0
Sinaloa	7.7	7.1	16.7	8.7		17.1	11.5	11.7
Nayarit				4.3				0.5
Subtotal	7.7	21.4	16.7	21.7	20.0	28.6	23.1	21.9
2 - Northern Highlands								
Zacatecas		7.1	16.7	4.3		1.4	3.8	4.7
Subtotal	0	7.1	16.7	4.3	0	1.4	3.8	4.7
3 - Northeast Coast								
Coahuila				4.3				0.5
Subtotal	0	0	0	4.3	0	0	0	0.5
4 - Western Highlands								
Jalisco	30.8	14.3	50.0	26.1	30.0	22.9	42.3	29.5
Guanajuato	3.8	21.4		8.7	20.0	12.9	7.7	11.0
Colima	3.8	7.1				2.9		2.4
Michoacan	46.2	28.6		30.4	20.0	27.1	15.4	23.9
Guerrero	3.8				10.0	4.3	3.8	2.8
Subtotal	88.5	71.4	50.0	65.2	80.0	70.0	69.2	69.5
5 - Central Highlands								
Hidalgo							3.8	0.7
Mexico	3.8							0.4
Subtotal	3.8	0	0	0	0	0	3.8	1.1
Mexico	100.0	99.9	83.3	95.7	100.0	100.0	99.9	97.6
Central America	0	0	16.7	4.3	0	0	0	2.4
Total Southern Zone	100.0	99.9	100.0	100.0	100.0	100.0	99.9	100.0
Sample size	26	14	6	23	10	70	26	175

[a]Baja California Norte and Sur combined.

Table A-35. Weighted distribution (%) of the mourning dove harvest in the Southern Zone by Western Management Unit State of banding. Immatures - direct recoveries.

Recovery area	Contributing area (%)							
	Wash.	Oreg.	Idaho	Utah	Nev.	Calif.	Ariz.	WMU total
1 - Northwest Coast								
Baja California[a]		9.1			11.1	6.5	4.5	4.7
Sonora						1.6	4.5	1.3
Sinaloa	7.7	9.1	25.0			16.1	9.1	10.9
Nayarit				7.7				0.9
Subtotal	7.7	18.2	25.0	7.7	11.1	24.2	18.2	17.9
2 - Northern Highlands								
Zacatecas				7.7		1.6		1.3
Subtotal	0	0	0	7.7	0	1.6	0	1.3
4 - Western Highlands								
Jalisco	30.8	18.2	50.0	38.5	33.3	24.2	50.0	34.3
Guanajuato	3.8	27.3		15.4	22.2	14.5	9.1	13.3
Colima	3.8	9.1				3.2		2.5
Michoacan	46.2	27.3		30.8	22.2	27.4	13.6	23.3
Guerrero	3.8				11.1	4.8	4.5	3.3
Subtotal	88.5	81.8	50.0	84.6	88.9	74.2	77.2	76.8
5 - Central Highlands								
Hidalgo							4.5	0.9
Mexico	3.8							0.3
Subtotal	3.8	0	0	0	0	0	4.5	1.3
Mexico	100.0	100.0	75.0	100.0	100.0	100.0	99.9	97.2
Central America	0	0	25.0	0	0	0	0	2.8
Total Southern Zone	100.0	100.0	100.0	100.0	100.0	100.0	99.9	100.0
Sample size	26	11	4	13	9	62	22	147

[a]Baja California Norte and Sur combined.

Table A-36. Weighted distribution (%) of the mourning dove harvest in the Southern Zone by Western Management Unit State of banding. Adults - direct recoveries.

Recovery area	Contributing area (%)							
	Wash.	Oreg.	Idaho	Utah	Nev.	Calif.	Ariz.	WMU total
1 - Northwest Coast								
Baja California[a]		33.3		10.0	100.0	25.0	25.0	22.1
Sonora				10.0		12.5		4.8
Sinaloa				20.0		25.0	25.0	13.2
Subtotal	0	33.3	0	40.0	100.0	62.5	50.0	40.1
2 - Northern Highlands								
Zacatecas		33.3	50.0				25.0	20.1
Subtotal	0	33.3	50.0	0	0	0	25.0	20.1
3 - Northeast Coast								
Coahuila				10.0				1.7
Subtotal	0	0	0	10.0	0	0	0	1.7
4 - Western Highlands								
Jalisco			50.0	10.0		12.5		13.2
Michoacan		33.3		30.0		25.0	25.0	23.2
Subtotal	0	33.3	50.0	40.0	0	37.5	25.0	36.4
Mexico	0	99.9	100.0	90.0	100.0	100.0	100.0	98.3
Central America	0	0	0	10.0	0	0	0	1.7
Total Southern Zone	0	99.9	100.0	100.0	100.0	100.0	100.0	100.0
Sample size	0	3	2	10	1	8	4	28

[a]Baja California Norte and Sur combined.

Table A-37. Derivation of the mourning dove harvest in the Western Management Unit; immatures - direct recoveries (weighted percentage).

Contributing area	Recovery area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	WMU totals
WMU								
Washington	303 (97.4)		1 (2.2)	2 (2.6)	3 (3.9)	32 (2.7)	4 (0.3)	345 (9.5)
Oregon		128(100.0)			1 (5.1)	22 (7.2)	2 (0.5)	153 (16.4)
Idaho	1 (2.6)		5 (88.9)			3 (2.1)	1 (0.6)	10 (2.2)
Utah				27 (92.2)		10 (2.3)	14 (2.6)	51 (3.8)
Nevada					32 (91.0)	12 (2.2)	15 (2.3)	59 (3.6)
California						768 (80.5)	25 (2.2)	793 (27.0)
Arizona						3 (0.7)	477 (89.3)	480 (35.5)
Subtotal	304(100.0)	128(100.0)	6 (91.0)	29 (94.8)	36(100.0)	850 (97.7)	538 (97.8)	1,891 (98.1)
CMU								
Montana			2 (9.0)	2 (5.2)		7 (1.2)	4 (0.6)	15 (0.8)
North Dakota							2 (0.3)	2 (0.1)
Minnesota						3 (0.2)	1 (0.1)	4 (0.1)
South Dakota							3 (0.4)	3 (0.1)
Wyoming						1 (0.2)	2 (0.4)	3 (0.2)
Missouri						1 (0.2)		1 (0.1)
Colorado						4 (0.5)	5 (0.5)	9 (0.4)
Subtotal	0	0	2 (9.0)	2 (5.2)	0	16 (2.3)	17 (2.2)	37 (1.9)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Other (Alberta)								
Subtotal	0	0	0	0	0	1 (Tr)	0	1 (Tr)
Total	304(100.0)	128(100.0)	8(100.0)	31(100.0)	36(100.0)	867(100.0)	555(100.0)	1,929(100.0)

Table A-38. Derivation of the mourning dove harvest in the Western Management Unit; adults - direct recoveries (weighted percentage).

Contributing area	Recovery area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	WMU totals
WMU								
Washington	47 (91.8)				1 (5.2)	8 (3.6)		56 (8.0)
Oregon	1 (4.1)	30(100.0)				10 (9.6)	2 (1.3)	43 (12.9)
Idaho	1 (4.1)		5(100.0)			2 (1.9)	3 (2.0)	11 (3.3)
Utah				53(100.0)			19 (2.6)	72 (4.5)
Nevada					30 (90.2)	5 (1.3)	8 (1.5)	43 (3.6)
California						222 (79.8)	7 (1.8)	229 (25.9)
Arizona					1 (4.6)	9 (3.6)	313 (88.3)	323 (40.7)
Subtotal	49(100.0)	30(100.0)	5(100.0)	53(100.0)	32(100.0)	256 (99.9)	352 (97.6)	777 (98.9)
CMU								
Montana							2 (1.0)	2 (0.5)
Minnesota							1 (0.1)	1 (0.1)
South Dakota						1 (0.1)	1 (0.1)	2 (0.1)
Wyoming							1 (0.4)	1 (0.2)
Colorado							6 (0.6)	6 (0.3)
Texas							1 (0.2)	1 (0.1)
Subtotal	0	0	0	0	0	1 (0.1)	12 (2.4)	13 (1.1)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Total	49(100.0)	30(100.0)	5(100.0)	53(100.0)	32(100.0)	257(100.0)	364(100.0)	790(100.0)

Table A-39. Derivation of the mourning dove harvest in the Western Management Unit; all ages and sexes combined - direct recoveries (weighted percentage).

Contributing area	Recovery area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	WMU totals
WMU								
Washington	350 (96.2)		1 (1.7)	2 (1.7)	4 (4.1)	40 (2.9)	4 (0.2)	401 (9.4)
Oregon	1 (0.9)	158(100.0)			1 (3.4)	32 (7.8)	4 (0.8)	196 (15.4)
Idaho	2 (2.9)		10 (91.5)			5 (1.9)	4 (1.2)	21 (2.6)
Utah				80 (94.9)		10 (1.0)	33 (2.6)	123 (3.9)
Nevada					62 (90.6)	17 (1.8)	23 (1.9)	102 (3.5)
California						990 (80.9)	32 (2.1)	1,022 (26.8)
Arizona					1 (2.0)	12 (1.7)	790 (88.9)	803 (36.6)
Subtotal	353(100.0)	158(100.0)	11 (93.3)	82 (96.6)	68(100.0)	1,106 (98.1)	890 (97.8)	2,668 (98.3)
CMU								
Montana			2 (6.7)	2 (3.4)		7 (1.0)	6 (0.7)	17 (0.8)
North Dakota							2 (0.2)	2 (0.1)
Minnesota						3 (0.2)	2 (0.1)	5 (0.1)
South Dakota						1 (0.1)	4 (0.2)	5 (0.1)
Wyoming						1 (0.2)	3 (0.4)	4 (0.2)
Missouri						1 (0.1)		1 (Tr)
Colorado						4 (0.2)	11 (0.5)	15 (0.3)
Texas							1 (0.1)	1 (Tr)
Subtotal	0	0	2 (6.7)	2 (3.4)	0	17 (1.7)	29 (2.2)	50 (1.6)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Other (Alberta)								
Subtotal	0	0	0	0	0	1 (0.2)	0	1 (0.1)
Total	353(100.0)	158(100.0)	13(100.0)	84(100.0)	68(100.0)	1,124(100.0)	919(100.0)	2,719(100.0)

Table A-40. Derivation of the mourning dove harvest in the Western Management Unit; immatures - indirect recoveries (weighted percentage).

Contributing area	Recovery area													
	Washington		Oregon		Idaho		Utah		Nevada		California		Arizona		WMU totals	
WMU														
Washington	107	(98.0)	4	(4.9)	1	(1.2)			1	(2.4)	14	(2.8)	2	(0.3)	129	(9.2)
Oregon			18	(85.5)							10	(7.8)	2	(1.2)	30	(8.3)
Idaho					10	(97.5)	1	(18.2)			1	(1.6)			12	(7.0)
Utah			1	(3.3)			9	(54.3)			3	(1.6)	12	(5.0)	25	(4.8)
Nevada	1	(2.0)					1	(4.9)	13	(69.5)	14	(6.2)	12	(4.1)	41	(6.4)
California			3	(4.5)			1	(2.8)	2	(6.0)	244	(60.6)	20	(3.9)	270	(23.9)
Arizona							1	(6.0)	1	(6.6)	19	(10.2)	185	(77.4)	206	(32.4)
Subtotal	108	(100.0)	26	(98.2)	11	(98.7)	13	(86.3)	17	(84.6)	305	(90.8)	233	(91.9)	713	(92.0)
CMU														
Montana							1	(4.6)	2	(10.0)	6	(2.5)	4	(1.3)	13	(1.9)
South Dakota											1	(0.4)	1	(0.3)	2	(0.2)
Wyoming											1	(0.6)	5	(2.3)	6	(1.3)
Nebraska											1	(0.7)	1	(0.5)	2	(0.5)
Iowa											1	(0.4)			1	(0.1)
Missouri											1	(0.4)	1	(0.3)	2	(0.3)
Colorado			1	(1.8)			2	(6.6)			5	(1.5)	5	(1.1)	13	(1.4)
New Mexico					1	(1.3)	1	(2.5)	2	(5.4)	9	(2.0)	12	(2.1)	25	(2.0)
Texas											1	(0.6)			1	(0.2)
Subtotal	0		1	(1.8)	1	(1.3)	4	(13.7)	4	(15.4)	26	(8.9)	29	(7.9)	65	(7.8)
EMU														
New York											1	(0.1)			1	(Tr)
Ohio											1	(0.2)	1	(0.2)	2	(0.2)
Subtotal	0		0		0		0		0		2	(0.3)	1	(0.2)	3	(0.2)
Total	108	(100.0)	27	(100.0)	12	(100.0)	17	(100.0)	21	(100.0)	333	(100.0)	263	(100.0)	781	(100.0)

Table A-41. Derivation of the mourning dove harvest in the Western Management Unit; adults - indirect recoveries (weighted percentage).

Contributing area	Recovery area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	WMU totals
WMU								
Washington	30 (87.7)	2 (7.1)	1 (5.8)		1 (5.3)	5 (3.7)	2 (1.2)	41 (10.0)
Oregon	2 (12.3)	11 (82.3)				4 (6.2)	2 (2.6)	19 (9.8)
Idaho			6 (73.1)					6 (3.1)
Utah			4 (10.0)	27 (76.9)		3 (1.0)	9 (2.4)	43 (4.6)
Nevada				1 (3.8)	28(86.2)	7 (3.0)	5 (1.8)	41 (5.8)
California		1 (2.8)			2 (8.4)	138 (80.9)	6 (3.0)	147 (28.5)
Arizona		1 (3.1)		3 (17.4)		8 (5.2)	152 (83.7)	164 (35.4)
Subtotal	32(100.0)	15 (95.3)	11 (88.9)	31 (98.1)	31(99.9)	165(100.0)	176 (94.8)	461 (97.1)
CMU								
Montana			1 (9.3)				3 (3.0)	4 (1.6)
North Dakota		1 (3.3)						1 (0.2)
South Dakota			1 (1.8)				2 (0.4)	3 (0.2)
Wyoming							1 (0.7)	1 (0.3)
Colorado				1 (1.9)			2 (0.4)	3 (0.2)
New Mexico		1 (1.4)					3 (0.7)	4 (0.4)
Subtotal	0	2 (4.7)	2 (11.1)	1 (1.9)	0	0	11 (5.2)	16 (2.9)
EMU								
Subtotal	0	0	0	0	0	0	0	0
Total	32(100.0)	17(100.0)	13(100.0)	32(100.0)	31(99.9)	165(100.0)	187(100.0)	477(100.0)

Table A-42. Derivation of the mourning dove harvest in the Western Management Unit; all ages and sexes combined - indirect recoveries (weighted percentage).

Contributing area	Recovery area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	WMU totals
WMU								
Washington	137 (94.4)	6 (5.2)	2 (2.1)		2 (2.7)	19 (3.1)	4 (0.5)	170 (8.8)
Oregon	2 (4.6)	29 (84.9)				14 (7.5)	4 (1.7)	49 (8.5)
Idaho			16 (88.3)	1 (7.4)		1 (0.8)		18 (4.9)
Utah		1 (1.2)	4 (5.7)	36 (68.7)		6 (1.3)	21 (3.5)	68 (4.8)
Nevada	1 (1.0)			2 (4.0)	41 (80.9)	21 (4.9)	17 (3.0)	82 (6.1)
California		4 (3.9)		1 (1.6)	4 (6.1)	382 (68.5)	26 (3.6)	417 (24.1)
Arizona		1 (1.7)		4 (10.9)	1 (2.7)	27 (8.4)	337 (81.1)	370 (37.3)
Subtotal	140(100.0)	41 (97.0)	22 (96.1)	44 (92.6)	48 (92.4)	470 (94.6)	409 (93.5)	1,174 (94.6)
CMU								
Montana			1 (2.0)	1 (2.7)	2 (5.3)	6 (1.9)	7 (1.7)	17 (1.7)
North Dakota		1 (1.6)						1 (0.1)
South Dakota			1 (1.0)			1 (0.2)	3 (0.4)	5 (0.2)
Wyoming						1 (0.4)	6 (1.7)	7 (0.8)
Nebraska						1 (0.3)	1 (0.2)	2 (0.2)
Iowa						1 (0.2)		1 (Tr)
Missouri						1 (0.3)	1 (0.2)	2 (0.2)
Colorado		1 (0.7)		3 (3.7)		5 (0.7)	7 (0.7)	16 (0.7)
New Mexico		1 (0.7)	1 (0.9)	1 (1.2)	2 (2.3)	9 (1.2)	15 (1.5)	29 (1.2)
Texas						1 (0.3)		1 (0.1)
Subtotal	0	3 (3.0)	3 (3.9)	5 (7.4)	4 (7.6)	26 (5.3)	40 (6.4)	81 (5.3)
EMU								
New York						1 (0.1)		1 (Tr)
Ohio						1 (0.1)	1 (0.1)	2 (0.1)
Subtotal	0	0	0	0	0	2 (0.2)	1 (0.1)	3 (0.1)
Total	140(100.0)	44(100.0)	25(100.0)	49(100.0)	52(100.0)	498(100.1)	450(100.0)	1,258(100.0)

Table A-43. Derivation of the mourning dove harvest in the Southern Zone; immatures - direct recoveries (weighted percentage).

Recovery area	WMU contributing area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
1 - Northwest Coast								
Baja California		1(28.4)			1(16.0)	4(36.1)	1 (19.6)	7(100.1)
Sonora						1(31.5)	1 (68.5)	2(100.0)
Sinaloa	2 (6.3)	1(12.3)	1 (25.5)			10(39.0)	2 (16.9)	16(100.0)
Nayarit				1(100.0)				1(100.0)
Subtotal	2 (3.8)	2(14.9)	1 (15.6)	1 (5.2)	1 (4.2)	15(35.6)	4 (20.6)	26 (99.9)
2 - Northern Highlands								
Zacatecas				1 (68.4)		1(31.6)		2(100.0)
Subtotal	0	0	0	1 (68.4)	0	1(31.6)	0	2(100.0)
4 - Western Highlands								
Jalisco	8 (8.0)	2 (7.8)	2 (16.2)	5 (13.4)	3 (6.6)	15(18.5)	11 (29.5)	46(100.0)
Guanajuato	1 (2.6)	3(30.0)		2 (13.8)	2(11.3)	9(28.6)	2 (13.8)	19(100.1)
Colima	1 (13.6)	1(52.8)				2(33.6)		4(100.0)
Michoacan	12 (17.7)	3(17.2)		4 (15.8)	2 (6.5)	17(31.0)	3 (11.9)	41(100.1)
Guerrero	1 (10.4)				1(22.8)	3(38.7)	1 (28.0)	6 (99.9)
Subtotal	23 (10.3)	9(15.6)	2 (7.2)	11 (13.2)	8 (7.8)	46(25.4)	17 (20.4)	116 (99.9)
5 - Central Highlands								
Hidalgo							1(100.0)	1(100.0)
Mexico	1(100.0)							1(100.0)
Subtotal	1 (27.2)	0	0	0	0	0	1 (72.8)	2(100.0)
Mexico	26 (9.2)	11(15.1)	3 (8.6)	13 (12.3)	9 (7.0)	62(27.1)	22 (20.8)	146(100.1)
Central America	0	0	1(100.0)	0	0	0	0	1(100.0)
Total Southern Zone	26 (8.9)	11(14.7)	4 (11.1)	13 (12.0)	9 (6.8)	62(26.3)	22 (20.3)	147(100.1)

Table A-44. Derivation of the mourning dove harvest in the Southern Zone; adults - direct recoveries (weighted percentage).

Recovery area	WMU contributing area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
1 - Northwest Coast								
Baja California		1(37.7)		1 (7.8)	1(10.4)	2(28.4)	1(15.8)	6(100.1)
Sonora				1 (35.3)		1(64.7)		2(100.0)
Sinaloa				2 (26.0)		2(47.5)	1(26.5)	5(100.0)
Subtotal	0	1(20.8)	0	4 (17.1)	1 (5.7)	5(39.1)	2(17.4)	13(100.1)
2 - Northern Highlands								
Zacatecas		1(41.4)	1(41.3)				1(17.3)	3(100.0)
Subtotal	0	1(41.4)	1(41.3)	0	0	0	1(17.3)	3(100.0)
3 - Northeast Coast								
Coahuila				1(100.0)				1(100.0)
Subtotal	0	0	0	1(100.0)	0	0	0	1(100.0)
4 - Western Highlands								
Jalisco			1(63.2)	1 (13.0)		1(23.8)		3(100.0)
Michoacan		1(35.9)		3 (22.1)		2(27.0)	1(15.0)	7(100.0)
Subtotal	0	1(22.9)	1(22.8)	4 (18.8)	0	3(25.8)	1 (9.6)	10 (99.9)
Mexico	0	3(25.4)	2(16.9)	9 (15.7)	1 (2.3)	8(25.5)	4(14.2)	27(100.0)
Central America	0	0	0	1(100.0)	0	0	0	1(100.0)
Total Southern Zone	0	3(25.0)	2(16.6)	10 (17.1)	1 (2.3)	8(25.1)	4(14.0)	28(100.1)

Table A-45. Derivation of the mourning dove harvest in the Southern Zone; all ages and sexes combined - direct recoveries (weighted percentage).

Recovery area	WMU contributing area							
	Washington	Oregon	Idaho	Utah	Nevada	California	Arizona	Totals
1 - Northwest Coast								
Baja California		2(31.1)		1 (6.3)	2(13.4)	6(31.1)	2 (18.0)	13 (99.9)
Sonora				1 (24.6)		2(40.3)	1 (35.1)	4(100.0)
Sinaloa	2 (6.1)	1(10.3)	1(16.2)	2 (8.4)		12(41.1)	3 (17.9)	21(100.0)
Nayarit				1(100.0)				1(100.0)
Subtotal	2 (3.3)	3(16.5)	1 (8.7)	5 (11.2)	2 (4.7)	20(36.6)	6 (19.1)	39(100.1)
2 - Northern Highlands								
Zacatecas		1(25.7)	1(40.5)	1 (10.4)		1 (8.6)	1 (14.9)	5(100.1)
Subtotal	0	1(25.7)	1(40.5)	1 (10.4)	0	1 (8.6)	1 (14.9)	5(100.1)
3 - Northeast Coast								
Coahuila				1(100.0)				1(100.0)
Subtotal	0	0	0	1(100.0)	0	0	0	1(100.0)
4 - Western Highlands								
Jalisco	8 (9.7)	2 (8.2)	3(19.3)	6 (9.9)	3 (5.3)	16(21.7)	11 (26.0)	49(100.1)
Guanajuato	1 (3.3)	3(32.9)		2 (8.9)	2 (9.4)	9(32.9)	2 (12.7)	19(100.1)
Colima	1 (15.2)	1(50.9)				2(33.9)		4(100.0)
Michoacan	12 (17.9)	4(20.1)		7 (14.3)	2 (4.3)	19(31.8)	4 (11.6)	48(100.0)
Guerrero	1 (12.9)				1(18.6)	3(43.3)	1 (25.1)	6 (99.9)
Subtotal	23 (11.8)	10(17.3)	3 (8.2)	15 (10.5)	8 (5.9)	49(28.2)	18 (18.0)	126 (99.9)
5 - Central Highlands								
Hidalgo							1(100.0)	1(100.0)
Mexico	1(100.0)							1(100.0)
Subtotal	1 (34.0)	0	0	0	0	0	1 (66.0)	2(100.0)
Mexico	26 (9.5)	14(17.2)	5 (9.7)	22 (11.0)	10 (5.3)	70(28.7)	26 (18.5)	173 (99.9)
Central America	0	0	1(79.5)	1 (20.5)	0	0	0	2(100.0)
Total Southern Zone	26 (9.3)	14(16.8)	6(11.4)	23 (11.2)	10 (5.2)	70(28.0)	26 (18.1)	175(100.0)

Table A-46. Weighted percentage[a] of mourning dove direct recoveries that originated within State, Western Management Unit.

WMU recovery area	Percentage in-State recovery		
	Adult males	Adult females	Immatures
Washington	100.0 (25)	80.4 (24)	97.4(304)
Oregon	100.0 (17)	100.0 (8)	100.0(128)
Idaho	100.0 (3)	100.0 (2)	88.9 (8)
Utah	100.0 (35)	100.0 (16)	92.2 (31)
Nevada	100.0 (24)	73.2 (8)	91.0 (36)
California	78.9(140)	78.6(105)	80.5(867)
Arizona	90.5(245)	84.1(116)	89.3(555)

[a]Example: 79% of banded adult doves recovered in California were banded in California. Figures in parentheses represent total numbers of recoveries in States of recovery.

Table A-47. Chronological derivation of harvest for all mourning doves in Arizona, 1967-75.

State or area contributing to harvest	Number of direct recoveries				Contribution to harvest (%)[a]			
	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31
WMU								
Washington	3	1			0.2	1.1		
Oregon	3	1			0.7	3.6		
Idaho	3	1			1.1	5.7		
Utah	19	4			1.8	5.8		
Nevada	15	2			1.5	3.1		
California	22	4		1	1.7	4.8		11.5
Arizona	685	35	8	4	91.3	72.9	76.8	79.9
Subtotal	750	48	8	5	98.2	97.0	76.8	91.4
CMU								
Montana	4	1	1		0.5	2.1	9.6	
North Dakota	1		1		0.1		8.9	
Minnesota	1				Tr			
South Dakota	2		1		0.1		4.7	
Wyoming	3				0.5			
Colorado	6	1		1	0.3	0.9		8.6
Texas	1				0.1			
Subtotal	18	2	3	1	1.8	3.0	23.2	8.6
EMU								
Subtotal	0	0	0	0	0	0	0	0
Total	768	50	11	6	100.0	100.0	100.0	100.0

[a]Weighted.

Table A-48. Chronological derivation of harvest for immature mourning doves in Arizona, 1967-75.

State or area contributing to harvest	Number of direct recoveries				Contribution to harvest (%)[a]			
	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31
WMU								
Washington	3	1			0.2	1.6		
Oregon	2				0.6			
Idaho		1				12.8		
Utah	5	2			1.1	8.5		
Nevada	11				2.0			
California	17	3		1	1.7	5.9		23.0
Arizona	419	16	5	1	92.5	68.0	76.9	49.9
Subtotal	457	23	5	2	98.3	96.8	76.9	72.9
CMU								
Montana	3	1			0.5	3.2		
North Dakota	1		1		0.2		13.1	
Minnesota	1				0.1			
South Dakota	1		1		0.1		10.0	
Wyoming	2				0.5			
Colorado	3			1	0.4			27.1
Subtotal	11	1	2	1	1.7	3.2	23.1	27.1
EMU								
Subtotal	0	0	0	0	0	0	0	0
Total	468	24	7	3	100.0	100.0	100.0	100.0

[a]Weighted.

Table A-49. Chronological derivation of harvest for adult mourning doves in Arizona, 1967-75.

State or area contributing to harvest	Number of direct recoveries				Contribution to harvest (%)[a]			
	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31
WMU								
Oregon	1	1			0.8	9.6		
Idaho	3				2.4			
Utah	14	2			2.3	3.9		
Nevada	4	2			0.9	5.3		
California	5	1			1.5	3.6		
Arizona	266	19	3	3	90.2	76.3	62.4	100.0
Subtotal	293	25	3	3	98.2	98.7	62.4	100.0
CMU								
Montana	1		1		0.6		37.6	
South Dakota	1				0.1			
Wyoming	1				0.5			
Colorado	3	1			0.3	1.3		
Texas	1				0.2			
Subtotal	7	1	1	0	1.8	1.3	37.6	0
EMU								
Subtotal	0	0	0	0	0	0	0	0
Total	300	26	4	3	100.0	100.0	100.0	100.0

[a]Weighted.

Table A-50. Chronological derivation of harvest for all mourning doves in California, 1967-75.

State or area contributing to harvest	Number of direct recoveries					Contribution to harvest (%)[a]				
	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Nov. 21-Dec. 10	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Nov. 21-Dec. 10
WMU										
Washington	23	7	4			2.0	10.3	14.2		
Oregon	22	4	3		1	6.4	19.8	35.7		13.4
Idaho	5					2.3				
Utah	10					1.2				
Nevada	15	1				1.9	2.1			
California	849	38	12	2	17	82.7	62.5	47.6	75.7	76.1
Arizona	12					2.0				
Subtotal	936	50	19	2	18	98.6	94.7	97.5	75.7	89.5
CMU										
Montana	5	1			1	0.8	2.9			7.6
Minnesota			1	1	1			2.5	24.3	2.9
South Dakota	1					0.1				
Wyoming	1					0.2				
Missouri	1					0.1				
Colorado	2	2				0.1	2.5			
Subtotal	10	3	1	1	2	1.4	5.3	2.5	24.3	10.5
EMU										
Subtotal	0	0	0	0	0	0	0	0	0	0
Total	946	53	20	3	20	100.0	100.0	100.0	100.0	100.0

[a]Weighted.

Table A-51. Chronological derivation of harvest for immature mourning doves in California, 1967-75.

State or area contributing to harvest	Number of direct recoveries					Contribution to harvest (%)[a]				
	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Nov. 21-Dec. 10	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Nov. 21-Dec. 10
WMU										
Washington	19	5	4			1.9	7.6	21.5		
Oregon	15	4	1			5.9	23.5	20.8		
Idaho	3					2.4				
Utah	10					2.7				
Nevada	11	1				2.4	3.3			
California	660	31	8	2	14	82.0	58.0	53.1	74.2	87.2
Arizona	3					0.8				
Subtotal	721	41	13	2	14	98.2	92.5	95.4	74.2	87.2
CMU										
Montana	5	1			1	1.0	3.1			9.0
Minnesota			1	1	1			4.6	25.8	3.8
Wyoming	1					0.3				
Missouri	1					0.2				
Colorado	2	2				0.3	4.4			
Subtotal	9	3	1	1	2	1.8	7.5	4.6	25.8	12.8
EMU										
Subtotal	0	0	0	0	0	0	0	0	0	0
Total	730	44	14	3	16	100.0	100.0	100.0	100.0	100.0

[a]Weighted.

Table A-52. Chronological derivation of harvest for adult mourning doves in California, 1967-75.

State or area contributing to harvest	Number of direct recoveries					Contribution to harvest (%)[a]				
	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Nov. 21-Dec. 10	Sept. 1-10	Sept. 11-20	Sept. 21-30	Oct. 1-31	Nov. 21-Dec. 10
WMU										
Washington	4	2				2.2	26.5			
Oregon	7		2		1	8.0		57.1		51.2
Idaho	2					2.3				
Nevada	4					1.3				
California	189	7	4		3	81.7	73.5	42.9		48.8
Arizona	9					4.3				
Subtotal	215	9	6	0	4	99.8	100.0	100.0	0	100.0
CMU										
South Dakota	1					0.2				
Subtotal	1	0	0	0	0	0.2	0	0	0	0
EMU										
Subtotal	0	0	0	0	0	0	0	0	0	0
Total	216	9	6	0	4	100.0	100.0	100.0	0	100.0

[a]Weighted.

Table A-53. Direct recoveries in Mexico by 10-day periods for mourning doves banded in the Western Management Unit, 1967-75.

Age of bird banded	August			September			October			November			December		
	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-30
Adult															
Number	0	1	2	0	1	0	1	1	0	0	0	2	3	0	2
Percent	--	4.2	8.3	--	4.2	--	4.2	4.2	--	--	--	8.3	12.5	--	8.3
Immature															
Number	0	0	0	1	4	2	5	16	15	12	13	5	2	6	5
Percent	--	--	--	0.8	3.0	1.5	3.8	12.0	11.3	9.0	9.8	3.8	1.5	4.5	3.8

Age of bird banded	January			February			March			April			May		
	1-10	11-20	21-31	1-10	11-20	21-28	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31
Adult															
Number	0	2	2	0	0	1	3	0	0	1	1	0	0	0	1
Percent	--	8.3	8.3	--	--	4.2	12.5	--	--	4.2	4.2	--	--	--	4.2
Immature															
Number	3	7	3	7	2	1	5	4	2	6	2	1	2	1	1
Percent	2.3	5.3	2.3	5.3	1.5	0.8	3.8	3.0	1.5	4.5	1.5	0.8	1.5	0.8	0.8

Table A-54. Chi-square tests for sex-specificity of survival or recovery rates, or for both rates, among adult mourning doves in the Western Management Unit.

State	Years	X^2	df	P
Arizona	1964-74	53.3	23	0
California	1964-74	16.8	23	0.82
Idaho	1964-66	12.8	8	0.12
Nevada	1964-72	25.4	18	0.11
Oregon	1964-68	7.3	10	0.70
Utah	1964-74	29.0	23	0.18
Washington	1964-69	18.7	12	0.10
All States		163.3	117	0

Table A-55. Z-tests for the hypothesis of sex-specificity of survival and recovery rates in adult mourning doves in the Western Management Unit, 1967-74.[a]

State	$(\hat{f}_M - \hat{f}_F)$	z	P[b]	$(\hat{S}_M - \hat{S}_F)$	z	P[b]
Arizona	1.6	3.77	0	-4.7	-0.61	0.54
California	-0.1	-0.20	0.80	-2.6	-0.28	0.78
Idaho	0.6	1.66	0.10	-17.7	-1.55	0.12
Utah	0.1	0.43	0.71	12.5	1.37	0.19
Washington	-0.1	-0.10	0.92	6.9	0.56	0.58
All States	0.4	2.49	0.01	-1.1	-0.23	0.75

[a]Parameter estimates in Tables A-57 and A-58 were used in these tests.
[b]P = probability under the null hypothesis corresponding to a 2-tailed test.

Table A-56. Chi-square tests for geographic variation in survival or recovery rates, or for both rates, of adult mourning doves among coastal and interior States of the Western Management Unit, 1964-74.

States compared	Sex	Years	X^2	df	P
Interior States					
Arizona vs. Idaho	Male	1964-66	54.9	9	0
	Female	1964-66	34.1	7	0
Arizona vs. Nevada	Male	1964-72	145.0	19	0
	Female	1968-72	36.9	10	0
Arizona vs. Utah	Male	1964-74	266.3	22	0
	Female	1964-72	72.9	18	0
Idaho vs. Nevada	Male	1964-66	11.7	7	0.11
Idaho vs. Utah	Male	1964-66	9.5	7	0.22
	Female	1964-66	6.8	6	0.34
Nevada vs. Utah	Male	1964-72	35.9	18	0.01
	Female	1969-72	14.2	7	0.05
Coastal States					
California vs. Oregon	Male	1964-66	13.0	6	0.04
	Male	1972-74	5.9	5	0.32
	Female	1964-68	7.4	9	0.60
California vs. Washington	Male	1967-69	19.9	7	0.01
	Female	1966-69	3.0	8	0.93
Oregon vs. Washington	Male	1964-65	5.8	4	0.22
	Female	1964-68	13.1	10	0.22

Table A-57. Estimated survival and recovery rates (%) of adult male mourning doves banded preseason in the Western Management Unit, 1964-74. Program ESTIMATE.

State	Number banded	Number recovered	Model of best fit	Probability of fit test	Survival rate	SE	95% C.I.	Recovery rate[a]	SE	95% C.I.
Washington (1967-69)	568	35	M3	0.22	51.8	7.8	36.6-67.1	3.1	0.7	1.8-4.4
Oregon (1964-74)	967	41	--	--	--	--	--	--	--	--
Idaho (1964-66)	2,411	91	M1	0.20	46.4	9.3	28.2-64.6	1.6	0.3	1.0-2.1
Utah (1964-74)	5,834	134	M1	0.13	52.7	6.6	39.9-65.5	1.3	0.2	1.0-1.6
Nevada (1964-72)	3,042	92	M2	0.11	52.2	4.7	42.9-61.5	1.4	0.2	1.0-1.9
California (1966-74)	4,603	279	M1	0.16	49.5	3.9	41.8-57.1	3.7	0.3	3.1-4.3
Arizona (1964-74)	7,103	569	M0	0.10	35.5	4.1	27.5-43.5	5.1	0.3	4.5-5.7
Unweighted average					48.0			2.7		

[a]First-year recovery rate estimates are presented when model M0 is used.

Table A-58. Estimated survival and recovery rates (%) of adult female mourning doves banded preseason in the Western Management Unit, 1964-74. Program ESTIMATE.

State	Number banded	Number recovered	Model of best fit	Probability of fit test	Survival rate	SE	95% C.I.	Recovery rate[a]	SE	95% C.I.
Washington (1966-69)	499	28	M3	0.71	44.9	9.5	26.3-63.4	3.2	0.7	1.8-4.7
Oregon (1964-74)	573	26	--	--	--	--	--	--	--	--
Idaho (1964-66)	1,204	31	M3	0.86	64.1	6.6	51.2-77.0	1.0	0.2	0.5-1.4
Utah (1964-67)	1,586	41	M3	0.61	43.5	6.6	30.3-56.5	1.5	0.3	0.9-2.0
Utah (1969-72)	1,594	22	M3	0.39	36.9	10.7	15.9-57.8	0.9	0.2	0.5-1.4
Nevada (1964-74)	1,412	31	--	--	--	--	--	--	--	--
California (1964-74)	3,799	225	M0	--[b]	52.1	8.5	35.5-68.8	3.8	0.4	3.1-4.6
Arizona (1964-73)	5,605	289	M0	--[b]	40.2	6.5	27.5-52.9	3.5	0.3	2.9-4.1
Unweighted average					47.0			2.3		

[a]First-year recovery rate estimates are presented when model M0 is used.

[b]Data were insufficient for computation of M0 goodness-of-fit statistic. However, a more simple model (M1 or M2) fit the data and the M1 vs. M0 test provided strong evidence that M0 was the more appropriate test.

Table A-59. Estimated survival and recovery rates (%) of adult mourning doves banded preseason in the Western Management Unit, 1964-74. Program BROWNIE.

State	Number banded	Number recovered	Model of best fit	Probability of fit test	Survival rate	SE	95% C.I.	Recovery rate[a]	SE	95% C.I.
Washington (1964-69)	1,492	94	H02	0.12	41.2	3.5	34.3-48.2	3.9	0.4	3.0-4.8
Oregon (1964-74)	1,715	79	H02	0.10	40.7	3.9	33.1-48.3	2.8	0.4	2.0-3.5
Idaho (1964-66)	3,787	128	H02	0.75	50.8	6.2	38.6-62.9	1.6	0.2	1.2-1.9
Utah (1969-74)	5,936	86	H02	0.91	64.5	6.7	51.4-77.6	0.8	0.1	0.6-1.0
Nevada (1964-66)	1,819	37	H1	0.16	59.0	15.1	29.3-88.7	0.7	0.2	0.4-1.1
Nevada (1969-72)	2,334	79	H02	0.62	54.2	7.2	40.0-68.3	2.2	0.4	1.4-3.0
California (1964-74)	9,624	603	H2	0.53	56.1	4.0	48.2-64.0	3.7	0.2	3.3-4.2
Arizona (1964-74)	12,986	867	--	--	--	--	--	--	--	--
Unweighted average					52.4			2.2		

[a]First-year adult recovery rates are presented when model H2 is selected.

Table A-60. Estimated survival and recovery rates (%) of immature mourning doves banded preseason in the Western Management Unit, 1964-74. Program BROWNIE.

State	Number banded	Number recovered	Model of best fit	Probability of fit test	Survival rate	SE	95% C.I.	Recovery rate	SE	95% C.I.
Washington (1964-69)	6,577	544	H02	0.12	35.0	5.2	24.7-45.2	5.6	0.3	5.0-6.2
Oregon (1964-74)	3,200	225	H02	0.10	23.2	5.0	13.4-33.0	5.7	0.5	4.7-6.6
Idaho (1964-66)	3,808	107	H02	0.75	29.9	6.2	17.8-42.0	1.7	0.2	1.3-2.1
Utah (1969-74)	4,108	56	H02	0.91	47.3	12.6	22.6-72.0	1.0	0.2	0.7-1.3
Nevada (1964-66)	1,859	44	H1	0.16	30.9	11.9	7.6-54.1	1.8	0.4	1.0-2.5
Nevada (1969-72)	3,129	110	H02	0.62	43.4	9.2	25.4-61.5	2.2	0.4	1.4-3.0
California (1964-74)	25,100	1,497	H2	0.53	35.0	4.0	27.3-42.7	4.7	0.2	4.4-5.0
Arizona (1964-74)	17,728	983	--	--	--	--	--	--	--	--
Unweighted average					35.0			3.2		

Table A-61. Chi-square tests for age-specificity of survival or recovery rates, or for both rates, of mourning doves (sexes combined) in the Western Management Unit.

States	Years	Fit of H0			Fit of H1			H0 vs. H1		
		χ^2	df	P	χ^2	df	P	χ^2	df	P
California	1964-74	223.4	75	0	64.0	53	0.14	159.5	22	0
Idaho	1964-66	17.1	18	0.52	5.6	12	0.94	11.6	6	0.07
Nevada	1964-66	22.6	11	0.02	7.9	5	0.16	14.7	6	0.02
	1969-72	22.0	20	0.34	6.7	12	0.88	15.2	8	0.05
Oregon	1964-74	76.3	43	0	26.5	21	0.19	49.7	22	0
Utah	1969-74	21.5	22	0.49	9.5	10	0.49	12.1	12	0.44
Washington	1964-69	46.0	28	0.02	24.2	16	0.08	21.8	12	0.04
Composite		428.9	217	0	144.4	129	0.17	284.6	88	0

Table A-62. Estimates of the number of adult mourning doves to be banded annually to achieve a desired coefficient of variation of 0.06[a], assuming different survival rate, recovery rate, and years of banding.

Recovery rate (%)	Years of banding	Survival rate (%)		
		40	50	60
1	5	8,800	6,200	4,800
	10	2,600	1,600	1,100
3	5	2,900	2,100	1,600
	10	900	500	400
5	5	1,700	1,200	900
	10	500	300	200

[a]A coefficient of variation of 0.06 will result in 95% confidence limits of approximately ± 0.05-0.07 about the mean survival rate.

Table A-63. Production required to compensate for annual mortality in maintaining a stable breeding population of mourning doves in the Western Management Unit, 1964-74.

State	Survival rate (%)		Production required
	Adults	Immatures	Young per pair of adults
Washington (1964-69)	41.2	35.0	3.4
Oregon (1964-74)	40.7	23.2	5.2
Idaho (1964-66)	50.8	29.9	3.2
Utah (1969-74)	64.5	47.3	1.6
Nevada (1964-66)	59.0	30.9	2.6
Nevada (1969-72)	54.2	43.4	2.1
California (1964-74)	56.1	35.0	2.5
Unweighted WMU average	52.4	35.0	2.8

Table A-64. Differential vulnerability of immature and adult mourning doves in the Western Management Unit, 1967-75. Number of recoveries shown in parentheses.

States	Direct recovery rate		Average relative recovery rate
	Immatures	Adults	
Washington	5.27(374)	3.44 (56)	1.53
Oregon	5.78(164)	3.83 (46)	1.51
Idaho	0.89 (14)	0.93 (13)	0.96
Utah	1.11 (69)	0.93 (82)	1.19
Nevada	2.13 (68)	1.62 (45)	1.31
California	3.83(857)	2.96(237)	1.29
Arizona	4.03(507)	3.72(327)	1.08
Average			1.32[a]

[a]Excludes figures from Idaho because of small sample size.

Table A-65. Hunting mortality in relation to total annual mortality of mourning doves banded preseason in the Western Management Unit, 1967-75.

Function	Adults	Immatures
Recovery rate[a]	2.2	3.2
Harvest rate[b]	6.9	10.0
Kill rate[c]	9.9	14.3
Mortality rate[d]	47.6	65.0
Proportion of mortality attributed to hunting	20.8	22.0

[a]From Tables A-59 and A-60.
[b]Recovery rate ÷ band reporting rate = harvest rate; band reporting rate ≃ 32% (Tomlinson 1968).
[c]Harvest rate ÷ 1 - crippling rate = kill rate; crippling rate ≃ 30%.
[d]From Tables A-59 and A-60; 1 - survival rate = mortality rate.

Table A-66. Estimation of average mourning dove fall flight population.

I.	Estimating the number of mourning doves killed from the fall flight population.	
	Step	
	1. Average dove harvest in WMU, 1967-76 (Table A-3):	7,281,940
	2. Average WMU kill, assuming 30% crippling loss [Step 1 ÷ (1 - 0.30)]:	10,402,771
	3. Proportion of WMU kill derived from within the WMU (derivation from Table A-39):	0.983
	4. Kill of WMU-reared doves in WMU (Step 2 X Step 3):	10,225,924
	5. Proportion of doves banded in WMU that are recovered in WMU (% distribution from Table A-18):	0.933
	6. Total kill of WMU birds (Step 4 ÷ Step 5):	10,960,262
II.	Estimating the percentage of doves killed from fall flight populations.	
	1. Total doves banded in WMU (Table A-12):	88,540
	2. Total direct recoveries as the result of hunting (Table A-18):	2,859
	3. Direct recovery rate as the result of hunting (Step 2 ÷ Step 1):	0.0323
	4. Harvest rate if band reporting rate is assumed to be 32% (Step 3 ÷ 0.32):	0.1009
	5. Kill rate if crippling loss is assumed to be 30% [Step 4 ÷ (1 - 0.30)]:	0.1441
III.	Estimating fall flight populations.	
	1. WMU fall flight population (I, Step 6 ÷ II, Step 5):	76,060,111
	2. WMU breeding index or importance (Table A-1):	0.162
	3. Fall flight population of 48 conterminous States, projected from WMU estimate (Step 1 ÷ Step 2):	469,506,858

Appendix B. State Representatives on the Western Migratory Upland Game Bird Committee, 1967–1983

Alaska Department of Fish and Game	Daniel E. Timm Bruce Campbell
Arizona Game and Fish Department	Paul M. Webb David E. Brown Ronald W. Engel-Wilson Phillip M. Smith
California Department of Fish and Game	Harold T. Harper Jack R. Slosson
Idaho Fish and Game Department	Elwood G. Bizeau Elmer Norberg Richard Norell
Nevada Department of Wildlife	Joe Greenley Fred Wright Glen C. Christensen Larry Barngrover Terry E. Retterer
Oregon Department of Fish and Wildlife	Robert U. Mace Chester E. Kebbe Ralph R. Denney
Utah Division of Wildlife Resources	Darrell H. Nish S. Dwight Bunnell Jay A. Roberson
Washington Department of Game	Raleigh Moreland Garry Garrison Robert G. Jeffrey C. Fred Martinsen Tracy M. Lloyd
Fish and Wildlife Service Advisors to the Committee	Clinton H. Lostetter Kenard P. Baer Lytle H. Blankenship Carl J. Gruener John E. Chattin James C. Bartonek Roy E. Tomlinson

Appendix C. Individuals and Agencies That Banded More than 100 Mourning Doves in the Western Management Unit During 1967–1975

State of banding	Bander	Number of doves banded
Arizona	Arizona Game and Fish Department	20,250
	L. H. Blankenship	517
	Cibola National Wildlife Refuge	362
	Havasu National Wildlife Refuge	142
California	California Department of Fish and Game	26,240
	A. E. Weinrich	1,911
	E. C. Channing	1,005
	G. H. Wilson	341
	A. S. Leopold	254
	Sacramento National Wildlife Refuge	141
	T. J. Harper	104
Idaho	Idaho Fish and Game Department	1,426
	Deer Flat National Wildlife Refuge	1,061
	Camas National Wildlife Refuge	238
	Kootenai National Wildlife Refuge	218
Nevada	University of Nevada, Reno	2,465
	R. C. Branzell	1,678
	T. J. Harper	1,295
	A. Biale	173
	Ruby Lake National Wildlife Refuge	150
	Nevada Department of Wildlife	101
Oregon	Oregon Department of Fish and Wildlife	3,318
	W. L. Finley National Wildlife Refuge	236
	R. C. Branzell	229
	J. S. Cromwell	191
Utah	Utah Division of Wildlife Resources	13,772
	W. E. Ritter	592
	R. A. Gimby	274
	L. L. Broyles	139
	J. H. Hogue	137
	Ouray National Wildlife Refuge	116
Washington	W. W. Halstead	4,568
	Washington Department of Game	3,645
	Toppenish and Conboy Lake National Wildlife Refuges	211
	McNary National Wildlife Refuge	118

Appendix D. Glossary

The following definitions reflect usage of terms for mourning dove banding and recovery data in this analysis.

adult—A dove known to have hatched at least 1 year before the calendar year of banding.

age (or year) class—The approximate age of a dove at the time of banding.

all ages and sexes—For much of the analysis, banding and recovery data for adult males, adult females, unknown sex adults, and immatures were combined and inferences made for this entire dove population.

banding periods—Times of year when doves were banded.

bands—Serially numbered aluminum rings placed on legs of birds for identification.

Bird Banding Laboratory (BBL)—The BBL is the official repository for banding and recovery data of migratory birds in the United States and Canada. The BBL is located at the Patuxent Wildlife Research Center in Laurel, Maryland.

cohort—A group of doves sharing common characteristics as defined (i.e., age, sex, or origin).

coordinates—Coordinates identify the 1° block of north latitude and west longitude (grid) in which the banding or recovery occurred.

crippling rate (loss)—The proportion of hunter-downed doves that is not retrieved because the birds were wounded and lost.

derivation of the harvest—The relative importance (%) of breeding or natal areas of origin for specific harvest areas.

direct recovery—A banded dove killed or found dead during the first hunting season after being banded.

distribution of recoveries—The relative importance (%) of harvest areas for specific breeding or natal areas.

distribution of the harvest—The relative importance (%) of specific geographical areas within a general harvest area. This measurement can be expressed as percentages of total harvest or as harvest per land unit.

encounter—An observation of a previously-banded dove. Encounters may be obtained through hunting or finding birds dead, trapping, or sightings by observers.

goodness of fit—A chi-square test of how well the hypothesis being tested fits the observed data.

harvest—A general term for the number of doves killed in a particular area during the legal hunting season.

harvest areas—Areas where doves are harvested. Areas in the United States conform to State boundaries. Latin America was divided into eight regions, seven of which are in Mexico.

harvest rate—The hunter-related recovery rate adjusted to reflect the proportion of bands encountered but not reported. Recovery rate ÷ reporting rate = harvest rate.

hunting season—The period of time during each year when a legal dove hunting season was allowed. Hunting seasons in the United States extended from 1 September to 31 January; in Mexico and Central America, the hunting seasons encompassed 1 August through 31 May.

immature—A young dove capable of sustained flight known to have hatched during the same calendar year in which it was banded.

indirect recovery—A banded dove killed or found dead during any hunting season subsequent to the first hunting season after being banded.

kill—The number of doves shot by hunters or found dead during the hunting season. Throughout the text, "kill" is used synonymously with "harvest." However, when combined with "rate," its meaning is different.

kill rate—The proportion of a population dying as a result of hunting. Harvest rate ÷ 1−crippling rate = kill rate.

life equations—Mathematical models relating mortality rates to recruitment rates.

management units—Three administrative units in the United States (Eastern, Central, and Western) were defined by migratory differences of their respective dove populations. The WMU is composed of Washington, Oregon, Idaho, Utah, Nevada, California, and Arizona. The CMU and EMU are composed of States in central and eastern United States, respectively.

mortality—Mourning doves are continuously exposed to death from many causes such as starvation, inclement weather, disease, predation, and hunting. Banding data are utilized to estimate the proportion of mortality from all sources that occurs during a specific time period, usually 1 year.

mortality rate—The probability (%) that a bird alive when a given cohort is banded will not survive 1 calendar year to the time of next banding. 1 − survival rate = mortality rate.

nestling—A young dove still in the nest and incapable of sustained flight. Nestling banding data were omitted from this analysis.

normal wild-banded bird—A wild bird, apparently in good health, which has been captured, marked with a standard leg band, and immediately released at the location where banded.

option 1—Test of the null hypothesis in program BROWNIE that two adult data sets have similar survival and recovery rates. Banding and recovery periods must be identical.

permittee—The holder of a Federal migratory bird banding, marking, and salvage permit.

postseason—The 4½-month period of 15 January through 31 May immediately after the close of most dove hunting seasons in the United States. Banding data from this period were omitted from this analysis.

preseason—The 3-month period of 1 June through 31 August prior to the opening of dove hunting seasons (1 September). Only preseason bandings were considered in this analysis.

program BROWNIE—A computer program containing several *age-dependent* models to estimate survival and recovery rates for adult and immature mourning doves.

program ESTIMATE—A computer program containing several *age-independent* models to estimate survival and recovery rates for adult mourning doves only.

recovery—A banded bird killed or found dead and reported to the BBL. A recovery relates to a dead bird and is a terminal record.

recovery rate—This term refers to two different computations: Its traditional definition was the proportion of banded birds that is subsequently shot or found dead and reported to BBL. Recoveries ÷ bandings = recovery rate. Direct, indirect, and total recovery rates are computed in this manner. The computer derivation is the probability (%) that a banded bird alive when a given cohort is banded will be shot during the next hunting season and reported to the BBL. This estimate is a composite rate that was computed by either program BROWNIE or ESTIMATE and should not be confused with the traditional estimate.

recovery rate index—Direct band recovery rate multiplied by 10,000.

relative recovery rate—The probablity of an individual in one cohort being recovered in comparison to an individual in another (e.g., immatures:adults)

repeat (retrap)—A banded bird recaptured and released alive within the same banding coordinates and within the same 3-month period in which it was originally banded. Repeat records were omitted from this analysis.

reporting rate—The proportion of banded birds killed or found dead by hunters that is subsequently reported to the BBL. Recoveries ÷ hunter encounters = reporting rate.

return—A banded bird that was recaptured and released alive within the same coordinates in which it was originally banded at least 90 days from the date of banding. Return records were omitted from this analysis.

Southern Zone—The combined area of Mexico and Central America. This zone was further divided into eight regions, seven of which are in Mexico.

status—A BBL computer code which describes the physical condition of a bird at the time of banding (e.g., normal, experimental, etc.).

survival rate—The probability (%) that a bird alive when a given cohort is banded will survive 1 calendar year to the time of next banding.

tabulation—A computer-produced data summary printed on paper.

tiers—States of the CMU and WMU were arbitrarily grouped into north–south oriented tiers to compare derivation of harvest among the Southern Zone regions.

unknown-sex adult—An adult whose sex was not identified at banding.

weighting—An adjustment to the number of bands recovered from specific harvest areas to compensate for differences in banding efforts among origination areas, as well as varying sizes of areas and densities of breeding birds within them. Each recovery is placed in perpective to the number of birds it represents and allows computation of the relative contribution that all breeding areas make to the harvest of specific areas.

Tomlinson, Roy E., David D. Dolton, Henry M. Reeves, James D. Nichols, and Laurence A. McKibben. 1988. **Migration, harvest, and population characteristics of mourning doves banded in the Western Management Unit, 1964–1977.** U.S. Fish Wildl. Serv., Fish Wildl. Tech. Rep. 13. 101 pp.

An analysis of banding data for mourning doves from the Western Management Unit (WMU) yielded data about habitats, hunting regulations, and harvest in the WMU; distribution and derivation of band recoveries in and from the WMU; distribution of mourning dove harvest in Latin America from the WMU; chronology of migration; survival and recovery rates; effects of hunting on WMU dove populations; and an indirect estimate of the nationwide mourning dove population. Comparisons of these data were made with similar data from a companion study in the Central Management Unit.

Key words: Mourning doves, Western Management Unit, banding analysis, distribution, derivation, migration chronology, survival, recovery rate.

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